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CONTENTS.

ILLUSTRATED ARTICLES:	PAGE.	MISCELLANEOUS:	PAGE.
A Handy Wire Gauge	102	The American Bell Company's Capital	107
Small Zinc Accumulators for Telephone and Telegraph Purposes	102	Railroad Telegraph Facilities	108
Edison's Telephonic Inventions	103	The Electric Light in France	108
A Model Telephone Exchange System	104	The Baltimore & Ohio in Pennsylvania	108
The Continental Underground Cable Co.	106	The Philadelphia City Electrical Department	108
A New Insulator Bracket	108	The Finances of the New England Telephone Company	108
EDITORIAL PARAGRAPHS	101	A Special Sun for the City of Paris	108
MISCELLANEOUS:		DEPARTMENTS:	
Electric Lighting Tests by the Franklin Institute at Philadelphia	102	The Telegraph	109
Prosperity of the Mexican Telegraph Company	102	The Telephone	109
Stock Exchange Quotations	103	The Electric Light	109
An Analytical and Systematic Method of Inventing (continued)	105	Applications of Power	109
		Stock Quotations	109
		Miscellaneous Notes	109
		Business Notices	110
		Our Illustrated Record of Electrical Patents	110

New Advertisements.

Fleischmann's Electric Works—Electric Bell Outfits iii
John James—Position Wanted v
Jas. F. Hotchkiss—Mechanical Boiler Cleaner v
James W. Queen & Co.—Test Instruments v
Walworth & Lawton Mfg. Co.—Cross-Arms vii

REARRANGED ADVERTISEMENTS.

New York Safety Steam Power Co.—Steam Engines i
Leclanché Battery Co.—"Goods" ii
Western Electric Co.—Telegraph and Telephone Apparatus vii

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Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

PARTICULARS are given on the next page regarding the tests in progress at Philadelphia, of dynamos and lamps, under the direction of the Franklin Institute. The tests could not be committed to better supervision, and their results will, we have every reason to believe, be conclusive on all points they are intended to determine.

THE fate that threatens New York has come upon New Orleans. The local gas company, not succeeding in its efforts to get a renewal of contract from the city on its own terms, has decided to let the city go without gas and sit in darkness until it repents and yields. It does not appear that all the conditions insisted upon by the city are fair, but the company has put an end to parley and brought matters to a crisis.

BUSINESS relations between this country and Latin America are steadily on the increase, and one result is an extension of the systems of the Mexican Telegraph Company and of the Central & South American Telegraph Company. Last January we gave the annual report of the latter company, and to-day we give the report of the former. It will be seen receipts have been well maintained, while operating expenses have been very low. Dividends run about 8 per cent. per annum.

A DISPATCH in our columns to-day from York, Pa., tells the story of the advance of the Baltimore & Ohio Telegraph Company in Pennsylvania, despite the very active opposition of the Western Union Company. In connection with the narrative is given a list of men who, seeking election to office, have been defeated because of their friendly and business relations with the latter company. A "monopoly," and those who work with it, have to endure the expression of popular dislike, and pay the penalty even when they are in the right.

THE Drawbaugh interests, crushed to earth not long ago, have risen from the dust in the shape of the Drawbaugh Telephone Syndicate, incorporated in this State, with a capital of $3,000,000, divided into 3,000 shares of $1,000 each. The object of the syndicate is to do business in all parts of the country where the telegraph companies and the licensees of the American Bell Company have failed to provide for the wants of the inhabitants. The three incorporators, in order not to prevent any one from obtaining the stock, have self-sacrificingly limited themselves to only three shares each, leaving "enough to go around."

WE mentioned lately that the patrol in charge of the natural-gas pipes at Pittsburgh are provided for greater safety with portable incandescent lamps. This is similar to the practice in Paris, where an electric lamp and accumulator have been rendered obligatory for use by all plumbers hunting up leaks in gas-pipes. News now comes that in order to facilitate their operations in building a new gas-holder and make greater speed, the gas company at Brentford, England, have employed an arc lamp of 4,000 candle-power. The arc is suspended inside the gas-holder, and serves its purpose admirably. The engineers say that they have done their work in half the time that it would otherwise have required.

SOONER or later electricity may become the fashionable study. The Queen of the Belgians, while staying at her chalet at Ostend, recently, was enabled to hear the performance of Gounod's "Faust" at Brussels by means of the telephone. This feat aroused her curiosity, and she began at once the study of electricity, with the assistance of M. Van Rysselberghe and M. Charles Mourlon. She has made remarkable progress, and in return for their help has loaded her professors with valuable presents. Now the ladies of Belgium will follow her example, next the fashion will spread to other countries, and, maybe, before long we shall have all the "sweet girl graduates" in cookery here turning their attention to electricity under the direction of our most distinguished inventors.

QUOTATIONS have hitherto been supplied from the Stock Exchange here through the agency of the Gold and Stock Telegraph Company and its young rival, the Commercial Telegram Company, both collecting their own reports. In order the better to fight the "bucket shops" the governors of the exchange have resolved to take the collection of quotations into their own hands. The nimble reporters of the two companies will be excluded from the floor, and their work will be done by authorized employés of the exchange, the quotations then being given out to the operators of the companies, and thus distributed to the world at large. This change may make the collection of quotations more satisfactory to the exchange, but it is not very plain how it will affect injuriously the "bucket shops" or the other exchanges now ambitious to do regular Stock Exchange business.

WITH considerable flourish of trumpets, the New York Electric Manufacturing and Miscellaneous Exchange was started about a year ago. It was not without promise, and had the backing of sundry financial magnates and dignitaries of Wall street. The idea was that a large business could be done in miscellaneous stocks not listed on the other exchanges, and that electrical developments alone would supply a good field of occupation and commission for the brokers. New York has always been the leading market for telegraph stocks; electric light stocks are chiefly quoted here, and it was thought that the business in telephone stocks might be taken away from Boston. But the panic came, inopportunely, and nipped the project in the bud, as it did many others. The exchange fell into difficulties, found little or no business, changed its management, was unable to compete with the older exchanges, and now closes its doors.

AT last some one has been found willing to make tests in his own person with the properties of currents of high electromotive force, but the trouble is that he is not able to report on his sensations. It has long been proposed to employ electricity instead of the guillotine or the hangman's noose, but its advantages as a help to suicide have hitherto been overlooked. News comes from Paris that a man entered the dynamo room at the works of M. Chertemps in that city, and deliberately took hold of the bare conductors of a dynamo then feeding lamps. The result, of course, was instantaneous death, as the machine was one of high-tension current. It is to be hoped that would-be suicides will not make a note of this successful "taking off." If they do, the superintendents of electric light stations will have to be even more careful in excluding strangers from the premises, and one of the "live" subjects for discussion at the next electric light convention will be: "How shall we best keep would-be suicides out of arc light stations?"

ELECTRO-PHYSIOLOGY is not yet a very large chapter in electrical science, but it promises to become more extensive and important. According to the London papers, a well-known scientific man in England has given an order to a Liverpool dealer in wild beasts and rare animals for 100 specimens of the electric eel, his purpose being to study its power of imparting a shock to any one who handles its person or comes within the reach of its influence. There are very early historical notices of electric fish, and a great many experiments have been made with the torpedo and the gymnotus; but much remains to be learned. If the contract specifies gymnoti, the dealer will have a lively time in filling the order. Humboldt's graphic description of the manner in which the South American Indians catch the gymnoti, and of their great dread of the fish, will be remembered by many readers. The whole subject, including the electricity of plants, deserves further investigation, and we are glad to see that at least one electrician is preparing to follow up the work of Du Bois Raymond, Matteuci, Walsh, Faraday and others, by obtaining a generous equipment for experimental purposes of 100 electric eels.

DR. DE WATTEVILLE, the physician-in-charge of the electro-therapeutical department of St. Mary's Hospital, London, and an occasional contributor to the English electrical press, has in a recent number of the *British Medical Journal* given an account, that has attracted great attention, of the cures effected of writer's cramp by the system of Herr Julius Wolff, whose name is already known in connection with this subject. When a few months ago Herr Wolff went to settle in London, his arrival was regarded with interest by many of the principal physicians. Dr. de Watteville gives minute particulars of some of the cases in which the new treatment has succeeded in enabling sufferers from this most distressing affection to write clearly and without pain, thus confirming the observations made by the eminent professors, Billroth, in Vienna; Nussbaum, in Munich, and others. The massage consists of rubbing, kneading, stretching and beating of the fingers and the several muscles of the hand and arm. There are gymnastic exercises, both active and passive, and, most important of all, there are graduated exercises in writing, with a view of calling into play a new set of muscles in lieu of those injured by the cramp. The writer concludes by mentioning the case of a gentleman sent by him to Herr Wolff. Here the disease was of seventeen years' duration, and yet in less than a fortnight the patient was able to write for several hours a day, with almost normal rapidity and firmness. The subject of telegraphers' cramp has lately been discussed here, owing to its prevalence, and the opportunity is a good one for putting the Wolff system to a severe test. It is said to be curative of this affection that so sorely cripples many of our best operators.

OUT West the size of the farms is very often a serious obstacle to effective superintendence, but the manager of the Bell farm, of the Qu'appelle River Farming Company Canada, consisting of 13,000 acres under cultivation, has found in the telephone just the means of communication and control that is needed. Describing his system, he says: "One feature that is somewhat novel perhaps in our management is the employment of the telephone. At 8 o'clock every evening I put myself into communication with my divisional foremen. I give them perhaps ten minutes each. Every man must carry out my orders, right or wrong; if he does not, off he goes. Every horse, too, has its appointed task set every evening, sixteen to twenty miles a day; but here I am more merciful, and if a horse gives out, why, the foreman only has to go to his telephone and tell me of it, and I reduce the animal's task, taking off two miles a day, perhaps. The whole machine is worked in this way as easily by a single overseer as if it were a matter of thirteen and not of 13,000 acres; and all the discussion about the comparative advantages of large and small farming is really rather out of date, for the telephone enables you to combine them both. The telephone aids federation, which is quite as applicable, I assure you, to farms as to states. Every 200 acres has a cottage on it, with a man living in it rent free, and having charge of three horses. This system gives us an immense pull over other farms, such as Dalrymple's, the next biggest to ours, which are worked from a single centre, so that a team will have to go four or five miles, perhaps, to get to its work; that is sheer waste. These homesteads are grouped into divisions, of which there are five on the farm altogether, with a divisional foreman responsible for each. The men employed in each division report every day to the foreman, and the foremen report to me. Local matters are left to them; imperial concerns are reserved for me at my telephone." The advantages in convenience and economy of such a system, are apparent at a glance.

Electric Lighting Tests by the Franklin Institute at Philadelphia.

Although the Electrical Exhibition may be counted to have been a complete success, the reproach has been uttered that, unlike similar exhibitions, no definite tests of apparatus exhibited were undertaken in connection with it. While this is quite true, it must be admitted the necessarily short duration of the Exhibition made any extended or even trustworthy tests impossible; and thus far we are left in ignorance with regard to many interesting points relating to the apparatus and appliances exhibited. The report of the examining board on underground circuits says at the outset that no means were afforded for judging of the claims of the various exhibitors, and the board was limited to a mere exposition of the devices, with a few comments on their most obvious advantages or disadvantages.

We are glad to inform our readers, however, that the dynamo and incandescent lamp tests now in progress at Philadelphia are a direct outcome of the Exhibition, and that they bid fair to be among the most important tests of the kind ever made. They will be of especial interest on account of the fact that it is intended to continue the tests until the superiority of some one system is clearly demonstrated.

A part of the Exhibition building has been fitted up for the purpose, and the arrangements have been made by the Franklin Institute, under the direction and with the consent of the various companies whose apparatus is being tested.

The mechanical preparations for testing dynamos were completed and the electrical preparations were finished Saturday, March 7. After a series of experiments, the Tatham dynamometer was selected for use in the dynamo tests. Mr. Edison has three dynamos of 100, 200 and 400 ampères respectively, with E. M. F. of 120 volts, requiring 20, 40 and 80 horse-power. Mr. Weston has two incandescent dynamos and one arc dynamo, ranging from 35 horse-power up. The arrangements for the duration tests are most perfect in detail. The power will be furnished by a 25 horse-power engine, and the current will be supplied by an Edison dynamo of 100 ampères, the speed of which is gauged by means of a tachometer, and Weston's automatic regulator is used for the field. The Edison voltmeters are in constant use at different points, for the purpose of observation, and an Ayrton & Perry current meter is also in use. Special effort has been made to obtain regularity of speed and electric current.

The incandescent lamps entered for the duration test are as follows: Edison, 20 lamps of 16 candle-power; E. M. F., 96 volts. Weston, 20 of 16 candle-power; E. M. F., 110½ volts. Stanley, 10 of 16 candle-power; E. M. F., 92 volts; and 10 of 16 candle-power; E. M. F., 42 volts. Woodhouse & Rawson, 10 of 16 candle-power; E. M. F., 55 volts—making in all 70 lamps. A special test of efficiency is made on each lamp separately; it is measured in 60 different positions—and the average taken of these, to determine the mean spherical intensity of the illumination; at the same time the potential and current are carefully measured. After this efficiency test the lamps are subjected to a duration test, until a decided superiority of one system is shown. The room in which the duration tests are to be conducted has 70 cells, 6 inches square, arranged in a circle with a radius of 100 inches. Each lamp will be subjected to photometric, current and potential measurements made each day during its life. The room is carefully guarded by two attendants, who sleep in rooms on each side of the test room, and in addition two special watchmen will guard the lamps night and day. At the close of the photometric experiments each day, the only door of the room will be carefully sealed by the committee and companies represented, and will not be opened until the next day, for a repetition of the experiments.

The efficiency tests are complete, and the duration test is now in progress. The instruments used have nearly all been specially constructed for this work. The Methven standard two-candle burner is used in the photometric tests, while the lamp is presented in 60 different positions, by means of an ingenious arrangement which revolves in two circles at right angles to each other, and whose planes can be altered. Codes governing the dynamo and lamp tests have been approved and signed by the competing parties, and it is confidently believed that these tests will be among the most interesting that have ever been made.

A Handy Wire Gauge.

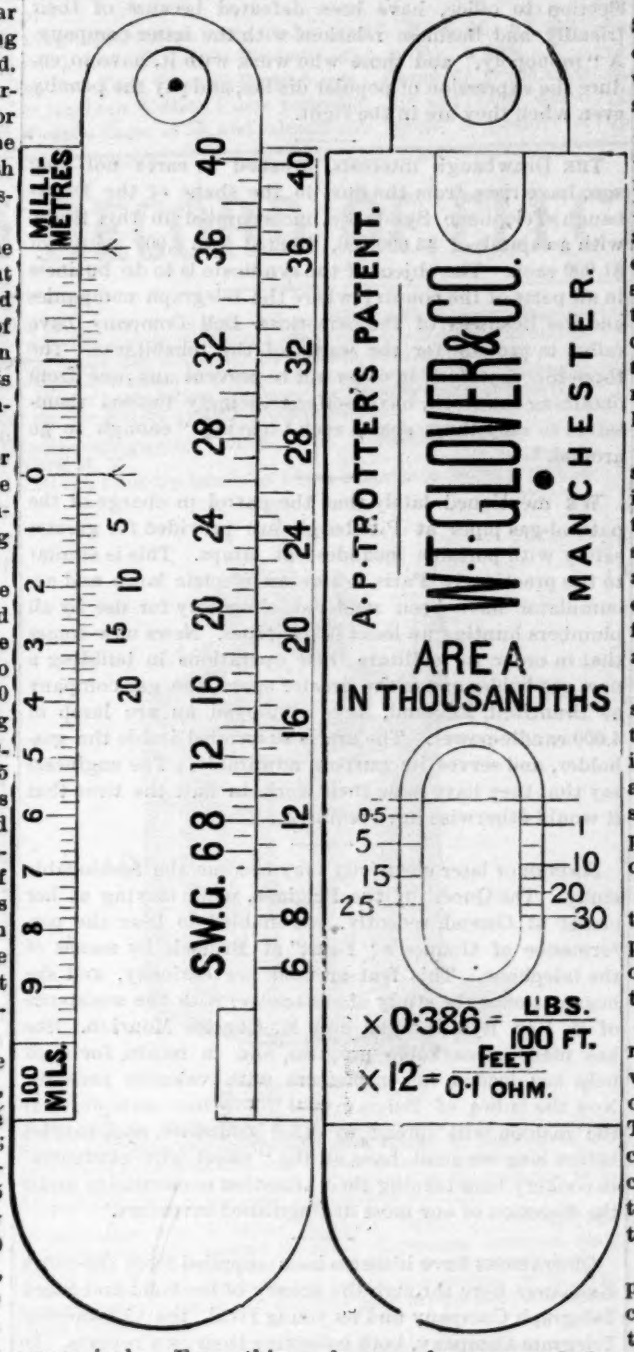
There has recently been introduced in England a gauge which deserves mention on account of the variety of calculations which can be performed by its use. The gauge, which is graduated according to the new English standard, comprises four separate scales, three of them being verniers.

The instrument is milled on the edges for convenience in holding, and may be opened by pushing the eye at the end of the slide. The wire or other article to be measured is placed between the jaws and nipped tight, the reading being taken on the scales.

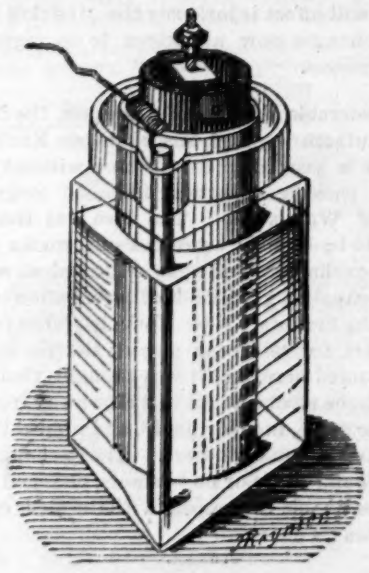
The S. W. G. (standard wire gauge) vernier is a peculiar one, and is read by observing the numbers of the graduations which *coincide*, the two numbers being identical. By its use the gauge of the wire can be accurately measured.

The two upper scales give very accurate readings of the diameter of the wire, both in mils (or thousandths of an inch) and in decimals of a millimetre.

On the back of the gauge is a scale by which the areas of circles, whose diameters are nipped between the jaws, may be approximately measured in thousandths of a



square inch. From this scale may be computed the capacity of high conductivity copper wire for carrying an electric current by any of the well-known formulas; but it is found that at all events up to No. 6. S. W. G., which is the largest diameter that the gauge will take, 1,000 ampères to the square inch is generally satisfactory, from considerations both of economy and resistance. The scale of areas may then generally be taken as a scale of ampères. The carrying capacity of the copper wire on an armature



A ZINC ACCUMULATOR.

or magnet may be found at once by multiplying the coefficient applicable to the particular case.

Knowing the area of the wire, mere multiplication by suitable coefficients gives the length in feet of pure copper wire having a resistance of one-tenth of an ohm, the ampères to the square millimetre and the resistance. As indicated above, the safe current for the wire can be read directly from the scale of areas, which, being in thousandths, gives the number of ampères—on the basis of 1,000 ampères to the square inch being a safe limit. Our illustrations, showing the front and back of the gauge, are three times the actual size.

Small Zinc Accumulators for Telephone and Telegraph Purposes.

The great expense and trouble of keeping a large number of primary batteries in order has led to the adoption of means to obviate the trouble, one solution of the problem being the substitution of dynamos as current generators. Since the advent of the storage battery, however, numerous attempts have been made to utilize it in telegraphic work, but with varying success. It is evident that a good storage battery possesses many advantages over a primary for this purpose, and it now remains to be seen whether an accumulator can be constructed which will meet the requirements of durability, compactness and cheapness. In a recent number of the *Electricien* there was illustrated a form of zinc storage battery, designed by Emile Reynier especially for telegraph and telephone purposes, which seems to possess some valuable qualities. By referring to the illustration it will be seen that the battery resembles closely a Leclanché cell in outward appearance, having the glass vessel, the porous cup and the amalgamated zinc rod in common with it. Here the resemblance ceases, however.

The positive electrode, placed within the porous cell, is a sheet of peroxydized lead folded three times upon itself in the direction of its length, perforated by numerous transverse slits and rolled in the form of a spiral. This is strengthened at the top by a copper bracket, upon which a binding screw is mounted. The effective surface of the electrode is about 16 square decimetres, the numerous perforations permitting communication between the interior and exterior.

The liquid is a solution of bisulphate of potash. The salt, in crystals, is thrown into the central space within the lead electrode. In order to put the cell in action, water is poured into the two compartments. This dissolves the acid salt in the porous cup little by little. It diffuses slowly and without great excess into the exterior compartment, where it dissolves the zinc when the circuit is closed.

The cell differs from Reynier's ordinary zinc accumulators in the substitution of sulphate of potash for free sulphuric acid, and in the employment of a porous cup, the object being to reduce to a minimum the local action in the zinc.

The electromotive force of the battery is 2.2 volts, its resistance 0.4 ohm, and it is capable of giving a normal working current of 1 ampère. It has a storing capacity of 11,000 kilogrammetres and weighs only 2.3 kilograms. These figures are noteworthy and make the battery especially valuable in telephone (microphone) work, as the increased current renders the variations in the resistance of the transmitter more distinct, and consequently increases the loudness and clearness of the sound.

The battery can be recharged in two ways, either by replacing the two electrodes and the liquid, or by sending a current from a dynamo through the cell in a reverse direction. Under ordinary circumstances recharging would be necessary every three months, and as the cells can stand 100 charges, their life would be about 25 years.

Prosperity of the Mexican Telegraph Company.

The condition of the Mexican Telegraph Company, as shown by a report to the shareholders by President James A. Scrymser, is very flattering. The receipts from Jan. 1, 1881, to Dec. 31, 1884, were $700,459.30, and the expenses but $224,890.44. Dividends of 8 per cent. were paid during the last three years, amounting to $301,826.68, and the total surplus after paying these dividends was $173,742.18. Of this amount $109,078.90 was applied to construction and investment, leaving a net surplus on Dec. 31 last of $64,663.28. The estimated net receipts for January were $11,000, and the dividend payable Feb. 11 $57,376, leaving a surplus beyond the dividend of $18,287.28. The original stock of the company, issued in 1880, was $1,000,000, which was all taken. This was increased in 1882 by $200,000, and in 1883 by $300,000. All the shares of the last two issues have been taken but 656, which still remain in the treasury of the company. In addition to this stock, which, estimated at par, is worth $65,600, the company owns 1,362 shares of the stock of the Central and South American Telegraph Company, which cost $127,450. These figures show the results of the operations of the company for three years and ten months from the beginning of its work, on March 3, 1881. The president, in his report, says that the operating expenses of the company average only 32 1/10 per cent. of its receipts; semi-annual dividends have been maintained at the rate of 8 per cent. per annum, and the annual surplus, it is expected, will provide amply for any contingency. The cables have not cost anything for repairs, and are believed to be in as perfect a condition as when laid. The receipts of the company have been well maintained in spite of the dullness of trade and a large reduction of the tariffs. The original capital provided for 476 miles of cable. The increased capital, with surplus earnings, has provided for the Galveston extension, consisting of 262 miles of cable, for the iron post land line, connecting Vera Cruz with the City of Mexico, 267 miles in length, and has paid for 1,362 shares of the stock of the Central and South American Telegraph Company.

Edison's Telephonic Inventions.*

BY PROF. EDWIN J. HOUSTON.

(*Concluded from page* 95.)

Since Edison employed a movable electrode in water for varying the current in a line, as early as 1873, in connection with his system of acoustic transmission, it is quite natural to find that he was one of the first to apply the principle to the operation of a transmitting instrument for a telephone, as soon as the telephone became generally known. He devised quite a number of liquid transmitters.

In Fig. 15 is shown one of the many forms of liquid

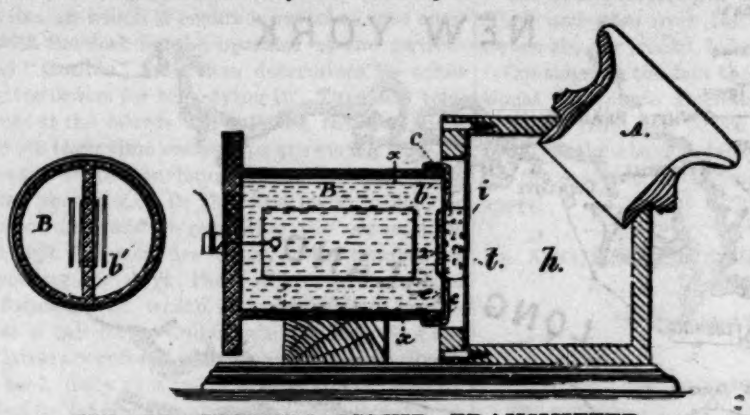


FIG. 15.—EDISON'S LIQUID TRANSMITTER.

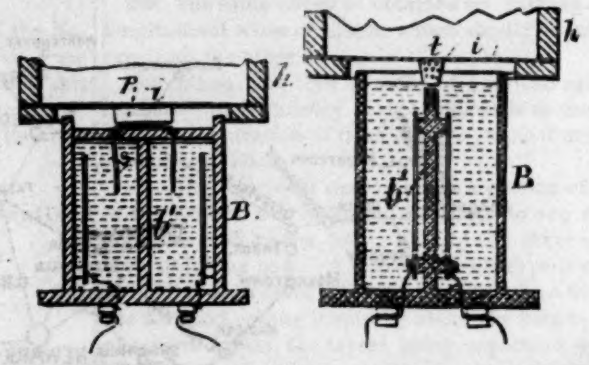


FIG. 16.—FORMS OF EDISON'S LIQUID TRANSMITTER.

transmitters devised by Edison. The instrument is shown in vertical longitudinal section; on the left is a vertical section on the line $x\,x$.

A mouth-piece A is attached to the hollow box h, which is provided with a rigidly attached diaphragm i, of mica, as shown. B is a cylinder of non-conducting material, divided by b^1, as shown in the vertical section on the left, into two compartments by a non-conducting material. The cylinder B is provided with two electrodes of platinum, carbon, or other conducting substances, connected respectively to line and earth. These electrodes project toward the diaphragm i, somewhat beyond the vertical non-conducting partition. The diaphragm i has rigidly attached to its face a piece of cork t, which projects inward through a slot in the end of the cylinder B, and when in position leaves a small space at 2, which limits the passage of currents between the electrodes.

When the sound waves fall on the mica diaphragm i, the passage 2 is alternately decreased and increased as the cork t is moved toward or from the electrode, and the resistance of the battery being thus varied, electrical undulations are thrown on the line.

Other forms of liquid transmitters are shown in Fig 16. On the right is shown a form similar to that described in connection with Fig. 15. In this case the cylinder B is vertical; the conducting liquid space between the cork t and the electrodes is more clearly shown. The division of the cylinder B into two separate compartments by the non-conducting partition b^1 is also more clearly shown.

On the left is seen a device in which the partition b^1 completely closes the two compartments. In this case

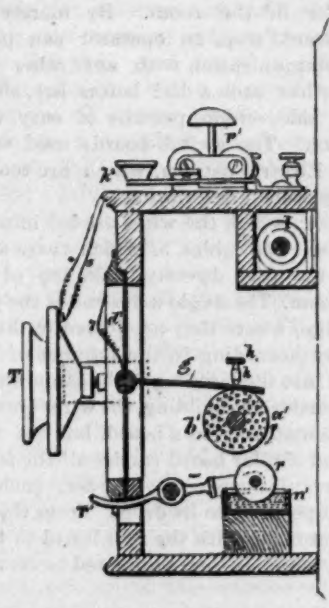


FIG. 17.—EDISON'S MOTOGRAPH TELEPHONE RECEIVER.

electrical communication is established between the electrodes by means of a conducting wire s, that is moved into or out of the liquid by the vibrations of the diaphragm. The liquid in B may be acidulated water or mercury.

One of Mr. Edison's most valuable contributions to telephony is to be found in his loud-speaking telephone. This instrument is based on the principle of his motograph, which he patented in the United States on Jan. 19, 1875. By the application of this principle to the telegraph, he was enabled to produce motions in distant telegraphic apparatus, independently of electro-magnetism or of the motion of galvanometer needles.

The principles of the motograph are well explained by Edison in United States Patent 158,787, as follows:

"The principles of its operation are that, when a moving surface is in contact with a slightly-yielding substance, the tendency is to move the latter by and with the former. If the circumstances of contact are varied, the adhesion of the surface will be sufficient to cause the moving surface to move the yielding substance, or else to cause the yielding substance to slip more freely, and by its spring go in the opposite direction to the moving surface. I have discovered that the passage of electricity through the surfaces in contact will change the frictional adhesion, making it more or less, according to the substances employed; and by balancing the chemical forces so that when the surfaces in contact are not electrified, the moving surface carries with it the yielding surface, and when electrified the yielding surface slips back over the moving surface, and *vice versa*, a mechanical movement is produced that is dependent on the electrical condition of the surfaces in contact; hence mechanical motion is obtained, first one way and then the other, that is as unlimited in its speed as the pulsations of electricity that pass, unobstructed by magnets, or other hindrances, over the telegraphic line."

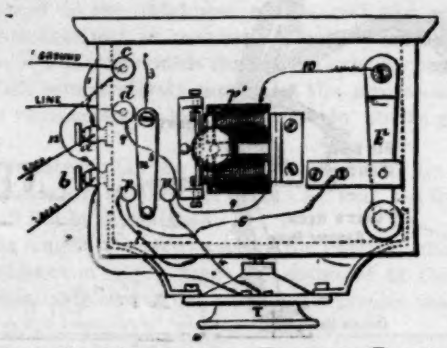


FIG. 19.—MOTOGRAPHIC RECEIVER (PLAN).

Edison describes in this patent a telegraphic instrument capable of being operated by means of the Morse system, in which the variations in friction obtained as above described are utilized.

Fully aware of the ability of an electrical current to vary the friction between two surfaces, and thus reproduce mechanical motions at the distant end of a telegraph line, it is quite natural that he should at an early date in his telephonic investigations turn his attention to the motograph principle in connection with systems of telephonic communication. This work resulted in the invention of his loud-speaking telephone, which he patented in the United States on Nov. 25, 1879.

Edison's motographic telephone is shown in section in Fig. 17.

In this form of apparatus he utilizes the variations in the friction of a metallic rod on a rotating chalk cylinder. The cylinder a^1 is of compressed chalk, soaked in some electrolyzable solution, such as caustic potash. The shaft b^1 is rotated by means of the handle f, shown in a back view of the same apparatus in Fig. 18.

Of course, the chalk cylinder may be rotated by clockwork, or by any other suitable means.

A flat metallic spring g, attached at one end to the centre of the diaphram d^2, rests on the surface of the chalk cylinder. The pressure of this spring against the cylinder is regulated by means of the screw h. In Fig. 19, a plan of this receiver is shown.

"The line-wire is connected to the spring g, while the earth-wire is connected to the shaft on which the cylinder a^1 is secured. If, now, the cylinder be rotated in the direction shown by the arrow and no current passes, the normal friction of the spring g, upon the surface of the cylinder a^1, will be very great, and the spring will be carried forward in the direction of the rotation of the cylinder, thus pulling inwardly the diaphragm d^2. If, now, a current passes, whose direction is such that hydrogen will be produced upon the surface of the spring g, in contact with the chalk, the friction will be reduced to an extent proportionate to the strength of the current; hence the diaphragm will regain its natural position and continue there as long as the current passes. If, now, the current ceases, the normal friction at once is re-established, the friction increases, and the diaphragm is violently pulled inwardly again. If, now, a current in the opposite direction is transmitted, the effect is hardly noticeable, as the evolution of oxygen on the surface of the spring g does not, except with a few saturations, decrease the friction like hydrogen; but on the contrary, generally tends to increase the normal friction."

Mr. Edison found that better results were obtained when a constant current was permitted to circulate on the line. He has also found that quite a number of different electrolytes may be employed to saturate the chalk cylinder. The acetate of mercury, mixed with caustic soda, is one of the best. In order to readily moisten the surface of the chalk cylinder the vessel u^1 is freely provided with water. The lever r^1 moves a felt wheel r against the chalk when the latter has become too dry.

The sound-waves impinging against the transmitter T, which contains the ordinary carbon button, vary the current of a battery that passes through the primary of an induction coil I, and thus produce positive and negative waves in its secondary coil, which passing over the line cause variations in the adhesion of a metallic strip to a rotating chalk cylinder, similar to that shown at a^1 and g, and therefore cause motions in its diaphragm that reproduce the speaker's voice.

Since the resistance of the spring and the chalk are greater when the chalk is at rest than when in motion, the chalk cylinder and its opposing spring may, if so desired, be employed as a transmitter in the place of the carbon transmitter.

* Journal of the Franklin Institute, Febru y, 1885.

Stock Exchange Quotations.

For more than a year the brokers in the Stock Exchange have been urging their governing committee to devise some means to prevent the daily quotations of stocks and bonds in their board room from being sent to rival exchanges and "bucket shops." It is claimed that the existence of the "bucket shops" causes a loss of business to the Stock Exchange brokers aggregating at least $1,000,000 a year. The governing committee resolved last week to make a radical change in the manner of handling the quotations. At present the prices of securities bought and sold on the floor of the Exchange are collected by agents of two "ticker" companies, one of which is the Gold and Stock Telegraph Company, controlled by the Western Union, and the other the Commercial Telegram Company, which has already a large list of subscribers. The quotations are supplied by the Gold and Stock to the Western Union Company, and by it they are distributed all over the country.

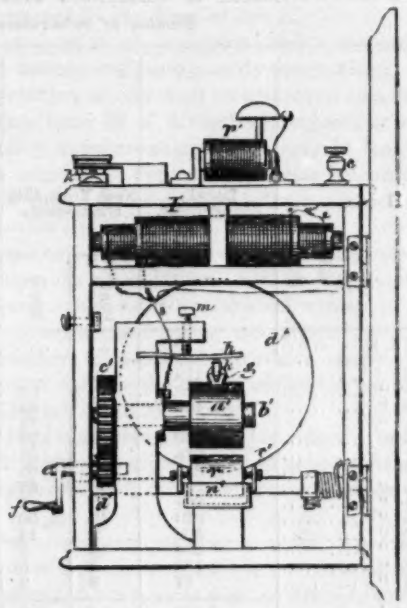


FIG. 18.—EDISON'S MOTOGRAPHIC TELEPHONE RECEIVER (BACK VIEW).

The Stock Exchange governors have resolved to take the collection of quotations into their own hands. The reporters for the two "ticker" companies will be excluded, and their work will be done by employés of the exchange. The quotations will be furnished to the operators of such "ticker" companies as choose to pay a rental for the privilege of having instruments in the building. The problem of how to distribute the quotations so that the "bucket shops" will not get them soon enough to profit by them is still unsolved. The governors will discuss it at their next meeting.

A Model Telephone Exchange System.

We think that it may be safely asserted that the history of invention can show no parallel to the rapidity with which the telephone has spread and become a necessary adjunct to the convenience, happiness and welfare of every civilized nation on the face of the earth. For this reason the telephone ranks deservedly as one of the greatest of inventions, and may be classed among the few which are said to mark epochs in the history of civilization.

In the great rush to adopt the telephone and to erect exchanges, however, it cannot be wondered at that in many instances *system* had to make way for *expedience*, with the result that the exchange, although in working order, failed from the lack of system to give satisfactory results, either to the subscribers or to telephone exchange managers. Now, after a few years of life, some exchanges have become systematized; but it may be safely remarked that a large number still lack the means for gathering information regarding the nature and extent of the business they do.

We propose to give our readers the details of a telephone exchange system which has had a great deal of care bestowed upon it, and which may fairly be claimed to be one of the most thoroughly organized and well arranged exchange systems in the country. The one we refer to is that of the New York and New Jersey Telephone Company, of which Mr. Wm. D. Sargent is general manager, and Mr. J. C. Rielly is superintendent, through whose personal efforts the extensive system has been brought to its present state of efficiency.

This company controls all the principal towns in Long Island and New Jersey, and the accompanying map will convey a good idea of the territory reached by its lines, which include 75 cities and towns within a radius of 50 miles, extending west as far as Trenton, N. J., and east as far as Babylon, L. I. The headquarters of the system are located in Brooklyn, at No. 397 Fulton street, where, also, is situated the Brooklyn Central Exchange office. The latter may be taken as representing a good example of the manner in which the business of an exchange ought to be conducted, and it is for this reason that we describe it. No doubt, a part of the description will fit other exchanges as well, but we believe Mr. Sargent has introduced some methods which may be new to some of our readers and may help other exchange managers to obtain information which will be of use to them in directing, enlarging or lessening the cost of their business.

MAP
SHOWING TERRITORY REACHED BY LINES —OF THE— NEW YORK & NEW JERSEY TELEPHONE Co

REPORT OF CONNECTIONS MADE AT BROOKLYN CENTRAL OFFICE, SATURDAY, FEB. 21, 1885.
Number of Subscribers—1,152. *Number of Operators*—17 *Day*, 2 *Night*.

Hours.	Local connections.	New York City connections.		Local Trunk Connections.						Long Island, New Jersey and New York State Connections.												Total.
				Williamsburg.		Greenpoint.		Bedford.		East New York.		Flushing.		Jamaica.		Astoria.		Babylon.		Far Rockaway.		
		Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	Sent.	Rec'd.	
12 to 6 A. M.	10	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	12
6 to 7 "	7	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	9
7 to 8 "	113	9	....	9	14	1	3	3	....	....	....	....	....	....	....	....	....	....	....	....	....	152
8 to 9 "	326	18	22	40	31	4	1	11	2	1	4	....	....	....	....	....	....	....	....	....	....	466
9 to 10 "	456	58	65	42	55	5	9	4	14	....	1	....	....	....	....	....	....	....	....	....	....	709
10 to 11 "	399	58	75	37	49	6	4	7	10	1	....	1	....	....	....	....	....	....	....	....	....	647
11 to 12 M.	370	59	72	36	44	6	7	3	7	1	1	....	....	....	....	....	....	....	....	....	....	606
12 to 1 P. M.	274	42	55	41	40	3	1	4	2	1	1	....	....	1	....	1	....	....	1	....	....	467
1 to 2 "	259	62	50	49	50	6	8	3	10	....	....	....	....	....	....	....	....	....	....	....	....	497
2 to 3 "	295	55	66	33	36	3	3	1	3	....	....	....	....	....	....	....	....	....	....	....	....	495
3 to 4 "	267	43	48	35	34	6	5	4	7	....	....	....	....	....	....	....	....	....	....	....	....	449
4 to 5 "	219	43	50	45	30	3	3	8	4	....	1	....	....	....	....	....	....	....	....	....	1	406
5 to 6 "	166	9	14	23	27	5	2	4	5	2	1	....	....	....	....	....	....	....	....	....	....	259
6 to 8 "	204	10	5	16	30	2	2	8	4	....	....	....	....	....	....	....	....	....	....	....	....	281
8 to 10 "	125	5	5	16	13	1	1	3	6	....	....	....	....	....	....	....	....	....	....	....	....	175
10 to 12 "	27	3	2	7	10	2	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	53
Total	3,517	474	529	429	464	53	51	65	75	6	9	1	....	1	....	1	....	....	1	....	1	5,677

The second floor of the building in which the exchange is situated is occupied by the executive offices of the company; the third floor contains the operating room, the repair shop, and the superintendent's office, in which latter the "trouble desk" is situated.

The first thing that attracts one's attention on entering the operating room is the almost complete silence that reigns even during the busiest time of day, notwithstanding the fact that 17 operators are constantly communicating with subscribers. The girls sit upon high-backed revolving chairs and a rail below supports the feet; some of them use the telephone headgear, while others prefer the shoulder-brace. The transmitters, however, are all suspended upon rods from above, so that the hands have free play below in order to make the necessary connections with facility. They are also provided with funnel-shaped mouthpieces, so that the operator by applying her mouth closely to the funnel can communicate with a subscriber without raising her voice above a whisper. Indeed, so low is the whisper, and so confined by the mouthpiece, that the writer, standing within a distance of two feet from an operator, was unable to distinguish the nature of the communication she carried on with the subscriber.

The room contains 10 direct switch-boards, of 100 drops each. Besides this there are two circuit switch-boards of 40 wires each, and finally, four trunk wire switch-boards of 10 wires each. The direct boards carry wires each of which goes to only one subscriber. The circuit boards, however, carry the connections for lines upon which two or more subscribers are situated, and who are called up by an individual call. These boards are situated side by side along one end of the room, while the trunk line switch-boards are placed on the other side. When an operator desires to get a connection on any other switch-board in the room, no direct verbal communication is resorted to. This is avoided by the use of a dial switch, from which wires lead to every other operator in the room. By merely turning an index to a lettered stop, an operator can put herself in telephonic communication with any other in the room. Each operator has such a dial before her, situated a little to the right side, which permits of easy and noiseless communication. The switch-boards used are of the regular Western Electric pattern, which are too well known to require any special description.

The manner in which the wires are led into the building is quite simple. The cables, of which there are a number, are run from the poles directly to the top of the window and into the room. The single wires end at the poles in front of the exchange, where they are joined to the wires in one or more cables (according to the number of wires on the pole), and led into the building in the same way as the other cables. Once inside the building, the wires are separated and arranged systematically on a board, but not numbered as yet. A second similar board carries all the terminals from the drops in regular consecutive order, each bearing the number corresponding to its drop. From this board connection is then made with the first board to the appropriate line wire, which is then numbered to correspond with the drop.

At this exchange, no lightning arrester of any kind on the single lines is used, nor is the subscriber's instrument protected. Mr. Sargent, general manager, asserts that his experience proves them to be unnecessary, at least in large districts, and as thus far no accident has occurred on account of their absence, it is fair to assume that the position he takes in this matter is justified.

The underground telephone system of Brooklyn centering at this station also presents some interesting facts of which a full account was given in our issue of Dec. 27, 1884. We will repeat here that there are in all 225 miles of conductors underground, which will allow the company to put more than three-fourths of their wires out of sight in the vicinity of the central office.

With this short sketch of the mechanical part of the system, as it may be called, we come to the clerical, and

to the system of book-keeping which has been established with such good results.

As in the majority of exchanges, the hours between eight and nine in the morning are used for calling up subscribers and ascertaining the working condition of the apparatus. When any trouble is noted by the operator, such as a weak transmitter, or if the subscriber reports his receiver weak, or should a ground or cross or any other trouble be detected, the operator simply makes a note of it and communicates with the official in charge of the "trouble desk" above mentioned. The person in charge of this desk is employed solely in keeping the working of the system up to the proper pitch of efficiency. The moment any trouble is reported, the line on which it occurs is switched into communication with the desk by the operator at the switch-board, and the "trouble" man then determines its exact nature, and gives orders for remedying it. Thus the telephone operators at the boards are relieved from all such work, and devote their time entirely to answering calls.

To the manager of the exchange room is detailed the task of keeping the books. In the first place, a diary or journal of general information regarding the occurrences of the day is kept. Herein are entered the number of operators reporting for duty, those sick or excused, and any other information of which it is desirable to keep a record, such as a call for an ambulance or police, or a fire alarm, which latter are entered with the exact time received.

In another book, daily account is kept of the number of instruments put in, taken out, or transferred, together with the stamped numbers of the instruments, and the name and address of the various parties. Thus a glance at the book showed that in January 110 connections and 35 disconnections had been made. Similarly, February showed 73 connections and 34 disconnections. A glance at another book shows the total number of subscribers; for as each one is connected, he is entered in regular order with his number. If a subscriber drops out, he is also entered, but in red ink, and, instead of adding one to the previous number, it is subtracted. Thus the last number in the book represents the actual number of subscribers.

Still another book keeps account of the number of wires in use. Turning to March 5, we find this record:

NUMBER OF WIRES, MARCH 5, 1885.

Direct	855
Circuit	84
Pay station	12
Office use	7
Long Island trunks	35
New York trunks	34
Total	1,027

One of the principal methods of ascertaining the business of the exchange is the system of making a complete record of every call and connection during twenty-four hours, once every week. These are not all made on the same week-day, but in rotation, so that the business of each individual day can be arrived at. The accompanying table will convey the idea better than any description of the process. Each operator, as she receives a call, makes a note of it on a slip of paper specially provided, using one slip for every call. At the end of each hour the slips are gathered and counted, those from each switch-board being kept separate. This form, when properly kept, shows at a glance the character and extent of the business of the exchange, gives a good means of judging of the requirements to meet the demands, and forms a definite basis of estimate. The figures which appear on the table give the number of actual connections; in addition to this, however, a record is also kept of the "misconnections," as they are called. By misconnection is meant the failure of the calling party to communicate with the other, no matter what the cause may be. These figures do not appear on our table; but in the real form, of which it is a copy, they are added in the same columns as the others, but in red ink and in smaller figures. Thus, in the present instance, 333 misconnections were reported during the day, making in all a little less than 6 per cent. The table also shows at a glance the business from hour to hour, and from each station, and, although not given here, the number of calls on each switch-board is also ascertained by counting the slips from each, as stated above.

These constitute the principal accounts kept, but the linemen are also greatly aided by diagrams showing all the principal poles and cross-arms. Each pin is numbered and above it in pencil the number of the wire is placed. Pencil marks are used in this case, because although the pin number remains constant, the number of the wire may change at any time. With these pole diagrams any "cross" can be readily located and trouble quickly removed. In addition to this all linemen are provided with blank forms which give in detail all the material used and time expended upon any work. These blanks when filled out are returned to the central office, the amounts charged up and the blanks filed.

Our limited space necessarily compels us to pass over other small matters that help to produce such good results, but from what has been noted our readers will get a fair idea of how an exchange ought to be conducted. We may add that Mr. Sargent has introduced this system into all the exchanges under his control, and the result is that by merely referring to the proper book he can at any time see the condition of the large system under his charge.

An inspection of the map will show that a large number of subscribers can be put in direct communication with one another. The number exceeds 12,000.

The system also makes communication with all the suburbs and sea-side resorts about New York and Brooklyn, so that a merchant can enjoy the sea-breeze and be at the same time in communication with his business office in town.

Trenton, N. J., presents the outside limit of the territory at present, and although more than 60 miles from Brooklyn, with the line passing through more than 3 miles of cable, we were enabled to carry on conversation very satisfactorily from Brooklyn with that city.

The cables referred to carry all the trunk lines to New York and pass over the Brooklyn bridge, being laid between the car tracks, below the foot-walk.

Considering the fact that, at the last meeting of the National Telephone Exchange Association, statistics were available from only 50,000 out of 150,000 subscribers in this country, the above details from one exchange speak well for the care and intelligence bestowed upon it by its managers.

An Analytical and Systematic Method of Inventing.

BY EDWARD P. THOMPSON, M. E.

(*Continued from page 62.*)

The following are a continuation of the principles of science deduced from the experiments of noted scientists and adapted to be applied to new inventions and to improvements of old inventions, according to rules established in preceding articles:

266. In a helix without an iron core, the greatest magnetic force for the smallest expenditure of energy is obtained when the R. of the helix is equal to that of the external circuit.

267. In an electro-magnet where the diameter of the core is equal to the thickness of the coil, the greatest efficiency is obtained, in magnetic effect, by making the resistance of the coils double that of the exterior circuit.

268. With comparatively small Cs., the electro-magnet should be comparatively long in order to obtain greater efficiency.

269. With strong Cs. the electro-magnet may be made shorter than when adapted for weak Cs., and yet the efficiency will not be diminished.

270. The length of electro-magnet for greatest efficiency is a little less than eleven times the diameter of the core for comparatively strong Cs., and a little greater than this proportion for comparatively weak Cs.

271. An armature of steel or a permanent magnet used as an armature is attracted with less resultant force by an electro-magnet than is a bar of soft iron.

272. Of two armatures of soft iron and of equal weight, that one is attracted most which is of a prismatic cross-section.

273. When a galvanic battery is the source of electricity the armature is attracted with a maximum force at the instant at which the circuit is closed, the force diminishing thereafter at a greater or less rate, according to the qualities of the battery.

274. In regard to the direction of attraction, the armature is attracted nearly twice as much in a direction of the major axis of the magnet as it is in a direction of the minor axis.

275. The magnetism of an armature does not completely leave the latter when the C is broken.

276. An armature is never attracted as strongly the second and third times, etc., as it is the first time.

277. After an armature has once been attracted, and when it is desired to make the armature move with the least magnetic force possible, its primary sensitiveness may be partially recovered by reversing the direction of the C.

278. As the attractive force of an armature is proportional to its mass, it will be more sensitive by an equivalent diminishing of its weight without diminishing its mass.

279. An equivalent means of diminishing the weight consists in placing the armature in a state of unstable equilibrium.

280. A second equivalent means of diminishing the weight consists in putting suitable pole pieces both upon the electro-magnet and the armature.

281. A third equivalent means of diminishing the weight consists in supporting the armature as stated in a previous principle, where a bar of iron is regulated, as to the force of gravitation upon it, by attaching it to a cord and adjusting it in the magnetic field of a magnet placed above the point of suspension of the bar, the said magnet being placed at such a distance above said point that the bar all but touches the magnet.

282. A fourth equivalent means of diminishing the weight consists in the release of a coil spring by the least movement of the armature.

283. A magnet having a tubular core, but possessing solid pole pieces, produces a greater resultant effect upon the armature than in the absence of the pole pieces.

284. The rate at which magnetic discharge and charge takes place when the C. is broken or completed depends upon the length of the magnet. The shorter the magnet the more rapid the rate in both cases

285. A permanent magnet supporting a weight will let that weight drop when the former is exposed to a comparatively high temperature, because heat of any extraordinary extent demagnetizes a steel magnet.

286. If a portion of the weight is properly counterbalanced it will drop after a time even if the steel magnet is not completely demagnetized.

287. An electro-magnet, if heated from an external source, will allow its armature to drop, the latter being properly counterbalanced by a spring or weight.

288. Sensitiveness to magnetization and demagnetization may be obtained by constructing the core of concentric iron tubes, each wound with one or two layers of coils, while the outer tube is wound with several layers.

289. The same effect is obtained by making the core of longitudinal wires or plates, which should be insulated the one from the other.

290. When the core is made of longitudinal wires not insulated, the efficiency of the magnet is increased as regards concentration of lines of force in the direction of the axis of the helix.

291. The core itself may be made a portion of the circuit of the wire of the helix, by soldering to one end of the core the ends of the helix, and to the other end of the core a binding post. A magnet of this type is obtained by attaching one end of a thin strip of iron tape to one end of the core and coiling it spirally about the core to the depth of several layers, the layers being separated by sheets of oiled paper.

292. A rotary or reciprocating axle or lever, or in general, any moving part of a machine or vehicle or vessel or natural object, may be converted into a generator of C. by attaching thereto a permanent or electro magnet and near by the moving object a helix, with a steel core.

293. The extra weight of the magnet, and the counter C. or magnetism induced in the moving magnet, both represent an expenditure of energy; so that there will be a tendency towards the restoration of movement of the moving object.

294. An electro-magnet is capable of new applications if wound with parallel and insulated and differently sized wires in the same or in opposite directions, instead of with one wire.

295. If a magnet is electroplated it is prevented from rusting, and if electroplated to different depths, the effective strength may be diminished; while a reverse C., during the process of electroplating, increases its effective attractive or repellant force, on account of the available distance between the object attracted and the magnetic poles being varied by the electroplated metal.

296. Adjustable magnets are applicable to cases where other magnets would not be suitable. They consist of any means whereby the poles of one magnet may be automatically or otherwise brought nearer together or separated to a greater distance.

297. Magnetic steel filings inclosed in a rubber or paper or cloth or felt or other flexible bag constitute one form of flexible magnet. If rubber be employed, the magnet becomes not only flexible, but also elastic in the direction of its axis.

298. By substituting iron filings instead of steel filings, a flexible core is obtained, which may be employed as a core to be inserted in any form of helix.

299. One or more stout or slender steel wires coiled into one or more helices and permanently magnetized, form a magnet which may at one time be employed as a bar magnet, at another time as a horseshoe magnet, at another time as a nearly annular magnet. It may be lengthened, compressed, twisted, or bent within limits depending upon the quality of the steel, length of helix, number of coils, diameter of wire and diameter of helix.

300. A combination of the two flexible magnets above mentioned consists of a closed rubber bag containing steel filings and one or more spiral steel wires.

301. Two or more steel tubes, magnetized, and fitting into one another telescopically, form a magnet whose length is limited only by the length of the longest tube and by the total length of all the tubes.

302. The tubes mentioned in the preceding principle, if made of soft iron, may each be wound as electro-magnets, and will then result in a tensile and compressible electro-magnet.

303. A tensile and compressible magnet is obtained by making it of two or more parts, the alternate or opposite ends being provided with male and female screw threads.

304. Two pieces of steel hinged by means of an ordinary pivot or universal joint form a magnet, when magnetized, which is equivalently flexible; or the pieces may be of soft iron and wound as electro-magnets.

305. The friction between two iron surfaces in contact may be increased by magnetizing the iron, so that by a regulation of the C. the friction may be regulated.

306. A body of soft iron sliding down an inclined surface of iron which is adapted to be magnetized, may be entirely or partially arrested in the motion according to the strength of the C.

307. A wheel of iron rotating upon an iron journal which is adapted to be magnetized, will be partially or completely arrested in its motion by the passage of a C.

308. Two straight electro-magnets suspended from the ends of a bar of soft iron by means of hinged joints form a flexible electro-magnet, and by the passage of a C. the two arms, or said straight electro-magnets, will assume

various angles according to the strength of the C., to the amount of friction at the hinge when no C. passes, to the weights of the arms, and to the comparative and absolute lengths of the parts of the flexible magnet.

309. According to the direction of the C., or to the direction of the winding in one or both of the said straight electro-magnets, and according to their relative dimensions and to the relative friction at the hinges, and to the relative strengths of C. in the said two straight electro-magnets, they will both hang at equal angles from the vertical, or at unequal angles, or one may be vertical and the other at an angle, and all of said angles may be either to the right or to the left of the vertical.

310. The combination of two or more coils with a permanent magnet, or with an electro-magnet through which a constant and continuous C. passes, furnishes an electro-magnet for obtaining a rapid action by its immediate adaptability to be magnetized and demagnetized.

311. Very thin and rather broad bands of well tempered and magnetized steel laid one upon the other and provided with caps covering the ends, said caps being connected with each other by flexible and elastic ligatures, or by only one of the said bands, form a flexible permanent magnet, in which the said bands individually bend and slide upon each other when subjected to the force of flexion, the sliding being due to the greater extent of flexure of the inner bands or strips.

312. A magnetic needle is steadily rotated in one direction with greater or less rapidity by suspending it over a ring electro-magnet and reversing the C. at intervals. Each reversal of C. impels the needle through one-half a revolution; or the needle may be suspended in the centre of an annular magnet, instead of over the same.

313. An armature, wound as an electro-magnet and located in a suitable position as to a permanent or electro magnet energized by an independent and steady C., may be given an intermittent motion by an intermittent C. through the armature, so that in the case of the permanent magnet, its attractive force is thereby, as it were, suspended at will by the passage of C.

(TO BE CONTINUED.)

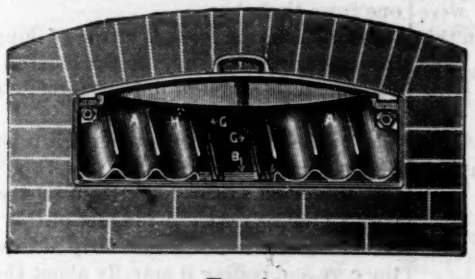


FIG. 1.

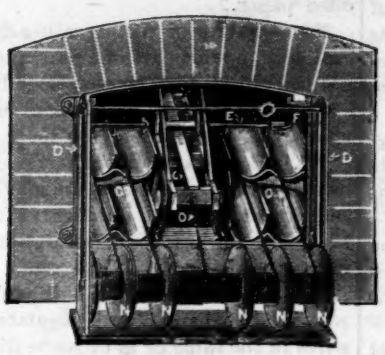


FIG. 2.

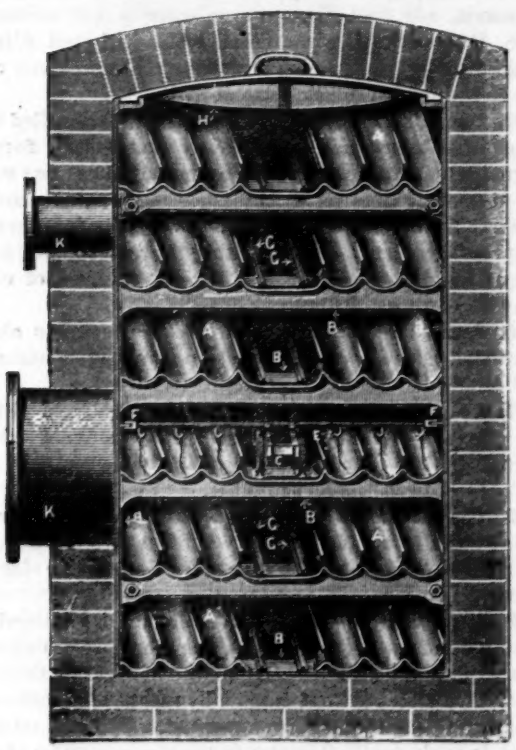


FIG. 4.

The Continental Underground Cable Co.*

("*A. b.*" *of the Section's Classification.*)

DESCRIPTION BY THE COMPANY, EDITED BY THE EXAMINERS.

This company's plans consist of two distinct systems. The first is described in Figs. 1, 2, 3, 4 and 5, and the second is described in Figs. 6, 7, 8 and 9. While it is here shown more particularly as an electric lighting system, it can as advantageously be applied to wires for other uses of electricity, and is adapted to cross streets, or where one company wishes its own separate conduit. The first-mentioned is the trunk line system, to accommodate all the different companies in one plant.

In the trunk line system the conduits are constructed with a view of keeping the dampness from penetrating them, by either making the walls of asphalt or asphalt blocks (or other anti-moisture material); or by constructing the walls of bricks laid with cement mortar and covering the outside with asphalt or cement to keep the moisture out, and then keeping them constantly under pressure of dry air.

In order to use a comparatively cheap cable, the conduits are kept dry for the protection and preservation of the cables. And further, they are kept under pressure, and objectionable gases are excluded, as dampness or gases will not enter against inside pressure.

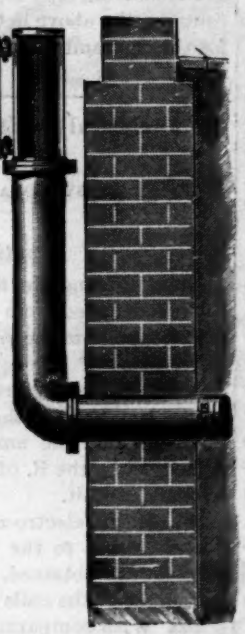
At first sight it may be said that there will be considerable cost attending the process of pumping dry air into the conduits, but a conduit of one, two or three miles in length may be kept under pressure by a very slight power from a single pump, which may be rented anywhere along the line and connection made to the conduits at a very small yearly cost to the company in conformity with the plan in the patent.

Every electric light company to have an engine running to compress the air supplied at the generating station for the tubes containing their own wires, as shown in Fig. 6. The principal object in keeping the wires and conduits under dry-air pressure is to prevent the escape of electricity from the wires, or to reduce the escape to a minimum. While this principle is adapted to telegraph and telephone wires, it is particularly adapted to underground electric light wires, where very heavy currents are passed; for on long circuits the lights on the farthest end of the line or circuit burn dimly and are incapable of giving that brilliancy of illumination for which they are designed, unless the intensity of the electric current is greatly increased over the normal, while this is injurious to the lamps near dynamo-electric machines and requires a greatly increased expenditure of power used in the generation of the current. By the use of the means employed by this company to retain the full force of the electric current, it is claimed that the distant lamps burn as brilliantly as those near the generators, and all burn with a maximum brilliancy without increasing the intensity of the current over the normal, and with a minimum expenditure of power. The accomplishment of this result depends mainly upon two phenomena, viz., the absorption of the moisture from within the conduits by chemically dried air (the moisture rendering the air a good conductor), and increasing the pressure or density of the air around the conductors and within the conduit by mechanical means, the same preventing the free escape of electricity from the wires.

The conduit should be made practically air-tight, with an air compressor at one end adapted to constantly force air into said conduit under pressure, the apparatus to contain an absorbent for the extraction of the moisture from said compressed air. An escape or pressure valve, adapted to remain closed until the desired pressure of air is obtained, should be attached to the conduit at its other end or at different places along it, so that when the air compressor is put in motion to force a constant current of air under pressure into the main and out through said relief valves, it will thereby insure a perfect circulation of chemically dry air under pressure.

The greater the pressure or more dense the atmosphere, and the more free the air is from moisture, the less liability is there for the escape of electricity, and *vice versa*. To follow a natural law which has been demonstrated, the more rarefied the air around an electric wire, and the more moisture it contains, the more freely will electricity escape from the wire. By this process every part of the space within the conduit (not occupied by the wires or their covering) will be occupied by compressed or dense dry air. The insulation should be perfect, as there will be no space so small that the compressed air will not instantly penetrate it. In the case of electric light wires, they will be supported within a tube by glass or porcelain supports, as represented in Figs. 7 and 8, and each wire having an air space surrounding it, the dry compressed air will encircle and insulate it perfectly from all others. A slight insulating covering as an extra precaution should also be used on the electric light wires.

One of the simplest forms, system No. 1, is shown in Fig. 1. A conduit for one or more cables of wires is arranged on each side of the track, to accommodate, combined, 800 wires.



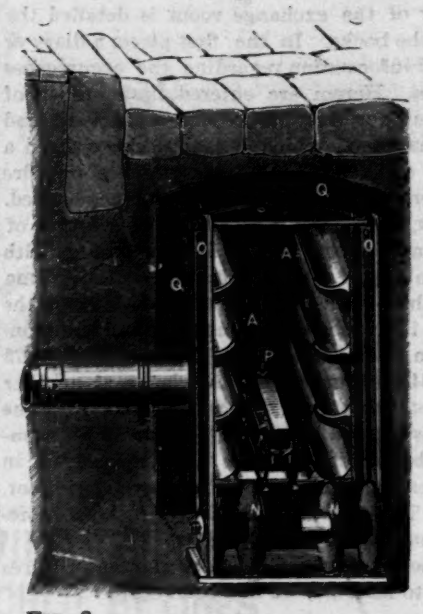


FIG. 3.

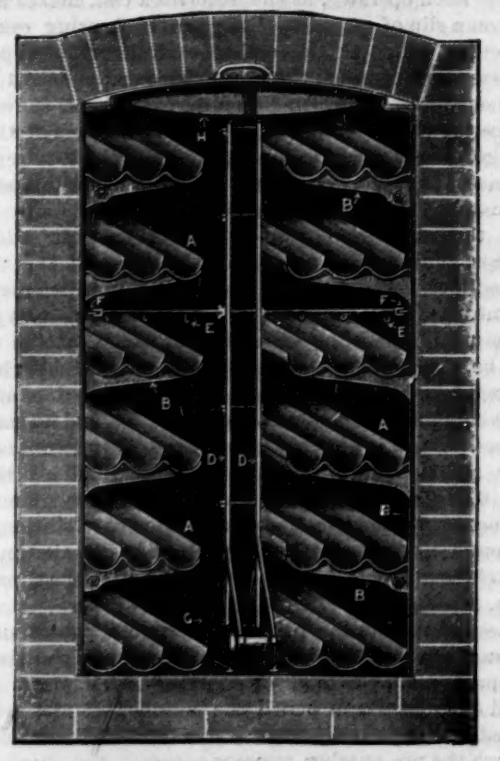


FIG. 5.

That shown in Fig. 1 will probably be sufficient for any one company for many years to come, but where more wires are required the capacity of Fig. 2 should be had. A single company will probably never require on any street more accommodation for wires than can be had by the conduit shown in Fig. 1, but should a greater capacity be required, the construction shown in Fig. 2 may be used, in which it is seen that pockets are arranged in a manner similar to that shown in Fig. 1, but two deep. In place of arranging pockets as shown in Fig. 2, they may be arranged as shown in Fig. 3, in which the pockets are arranged in single rows, one above the other, four deep.

Figs. 4 and 5 show the system for laying wires on a larger scale, which is especially adapted to accommodate a number of separate companies. Each of said fig

* Report of Board of Examiners, Section 18, Underground Conduits, International Electrical Exhibition, Philadelphia.

ures shows the same capacity, with but a slight difference in construction, the arms supporting the pockets in Fig. 4 uniting both uprights, and a track being furnished to each apartment of six pockets; while in Fig. 5 the arms or brackets do not thus unite, but leave a vertical passage way from top to bottom of the conduit, wherein the motor or carriage, running upon the rail of the bottom, causes its adjustable arms to travel when in the act of laying the cords, wires, or cables in the various pockets upon each side of said passage way. For an entire city only one motor and one carriage will be required; or if the process of laying the wires is to be carried on by either the carriage or motor alone, then the one or the other may be dispensed with. The pockets are made semi-cylindrical, 3 inches wide at the top and 1½ inches deep, or they may be made nearly cylindrical, with a slot on the upper or top side running the whole length, to admit of the chain or cord being laid in the pocket by the car with which to draw the cables into position. The space for the motor is between 5 and 6 inches wide, but reduced to 2 inches above the railway, and as it extends from the bottom to the top of the conduit, access to the cables without removing them from their pockets can be had from the top, if at any time it should be desired or become necessary.

A vertical space of one or two inches is left between the upper and lower pockets to permit the passage of the motor or carriage arm, and also to enable the cable to be tapped and the wire taken through an outlet. (See *K*, Fig 3.)

Service from the conduit to houses may be made by a connection run under the sidewalk and into the cellar, as shown in Fig. 3, conveying wires through said pipe into the house. The conduit before each house is provided with a plugged branch, which may be opened for connection when required.

Where a number of companies are using the construction shown in Fig. 4, each of said companies can place a suitably arranged lock to guard against admittance to their respective apartments.

Fig. 3 shows an electric motor in the act of drawing a cord or wire cable from a spool supported by an adjustable upright, temporarily placed in a manhole for the purpose; this cable, when laid, being adapted to draw the carriage through, which in turn lays a series of cords or cables in the various pockets, as shown in Fig. 2. If it is required that the carriage make two or more trips successively, then the carriage, in being drawn through, may also draw through an additional cable (see Fig. 2), by which said carriage may be returned after laying the first lot of cords or electric cable, and be in readiness for a second supply.

The plan is to place the largest number of wires in the smallest possible space after allowing for space to conveniently get at the wires, lay and relay them, for taking them off to houses, and for circulation of dry air, etc.

The walls of the conduit may be built of blocks made from asphalt compound, by an improved process, whereby it becomes impervious to moisture, and possesses great strength; and the metal uprights, brackets and pockets are connected with the earth to carry off induced electric currents. By this construction the conduit can be built more cheaply than if constructed entirely of iron, and in addition thereto is not so apt to become electrically charged.

The cylindrical sheet-iron pockets are formed by machinery and in sections of from 4 to 6 feet long, the ends of which are turned, to receive the supporting brackets, which clamp said pockets end to end. The uprights and brackets are bolted together in such a manner as to clamp firmly the ends of the pockets, thus uniting the adjacent sections, and thereby securing a substantially smooth pocket or trough, extending from one manhole to the next, the smooth surface overcoming any danger of injuring the cables in the act of drawing them through, and at the same time decreasing the labor. The uprights and pockets with the railway are fitted in the machine shop, and several sections, secured together, are lowered simultaneously to the foundation made for them in the street. These are then closed in and the conduit is complete.

It is estimated that the system just described can be laid with a capacity of from 12 to 15 pockets, adapted for different companies to use separate pockets for their own wires, each pocket having a capacity of 100 to 200 wires (according to the kind of wires or cables used), for from $8,000 to $10,000 per mile, depending upon the material used in the masonry.

Fig. 6 represents a general view of our electric lighting system, in which we have to deal with currents of electricity of high electromotive force. In such systems, in moist weather, or even owing to the dampness of an underground conduit, there is an escape of the current, and this materially reduces its tension so as to render the current incapable of producing a light of more than small candle-power at a short distance from the generating station. This has been one of the obstacles to placing electric lighting wires underground where the current was to be conveyed over long distances.

By this system the tension of the current is retained at its maximum, and so far as dampness is concerned, the tension is unaffected, thereby conveying currents underground over even longer distances than can be done above-ground under the ordinary variations of the hygrometric state of the atmosphere.

To attain this end the air within the conduit is kept under considerable pressure, and perfectly dry. If there is any appreciable amount of moisture in the atmosphere, the air-pump *H* forces the air first through a dryer *G*, which absorbs all the moisture, and the chemically dried air passes into the conduit *A*, and when the pressure becomes over a fixed amount, the relief valves *C* allow the excess of air to pass off, thus keeping the pressure in the conduit uniform. Currents of high tension tend to pass off the conductors, but this tendency decreases as the pressure of the surrounding medium (air) increases, and this effect is greatly increased by the thorough drying of the air in damp weather before passage into the conduit. The drying chemicals may be used over and over again, and the system is adapted to any substantially air-tight conduit. As the pressure is constant there must be an efflux, and should there be a small leak the passage of air will be from inside outward, thus preventing ingress of moist air.

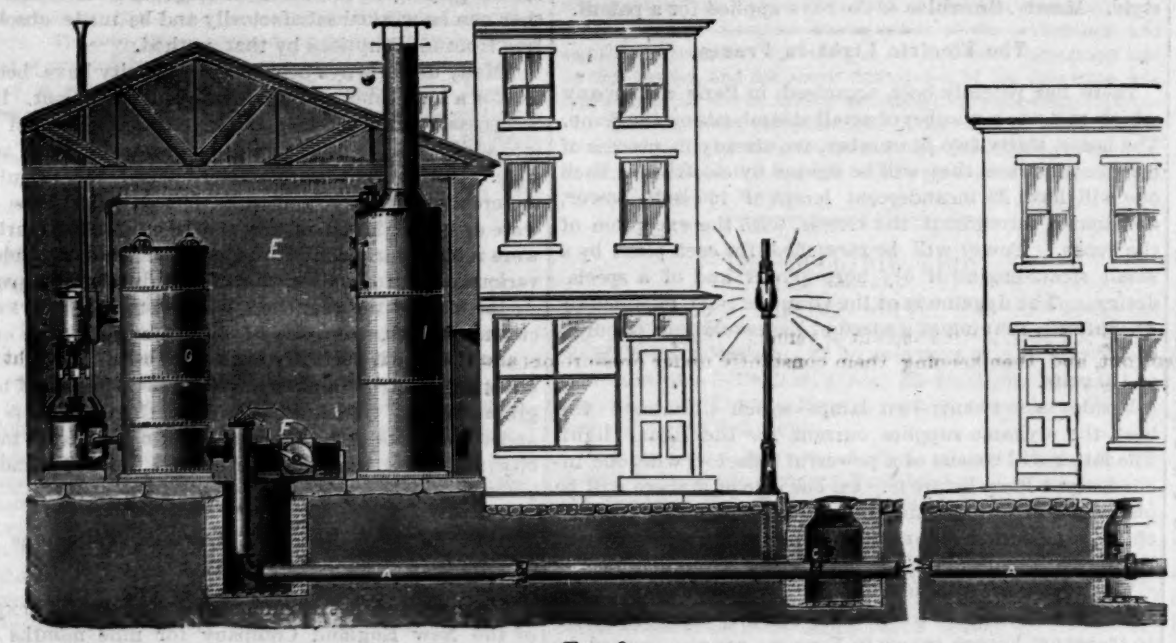


FIG. 6.

Figs. 7 and 8 represent end sections of conduits for electric lighting purposes, in which *B* are the conductors and *A* a metal pipe, the conductors *B* being supported by suitable insulators within said pipe. The conduit *A*, Fig. 6, may be continuous with testing doors in the manholes *B*, or if desired the conduit *A* may be open on the ends where it enters the manhole, as shown in Fig. 9, in which the door *D* is made air-tight and covered by an auxiliary cover *F* on the road, the said door *D* being provided with the relief valve *C*. In this construction the manhole is filled with compressed air.

This principle may be applied to general conduits, which may also carry the electric light wires, or instead of supplying the whole conduit with compressed air the electric light wires may be inclosed in leaden or iron tubes, and when laid in the conduit, air may be forced under pressure through said pipes.

Comments by the Examiners.

While the system just described is more particularly intended for electric light wires, if applied successfully to currents of high tension it can more easily maintain a good electrical condition for telegraph and telephone wires; a pipe conduit 3½ inches in diameter can be laid for about $3,000 per mile, and will contain at least 300 wires.

If absolutely dry air could be maintained in this conduit, no doubt it would be attended with many of the advantages claimed for it. But it would be exceedingly difficult to insure in any conduit of masonry, however carefully built, absolute immunity from moisture; and to keep such a conduit, with its many manholes and outlets, under air pressure, would, it is thought, be quite impracticable.

The employment of an electric motor to run a cord or chain through the duct for the purpose of feeding in the wires appears to be a refinement which, to say the least of it, lacks simplicity. Further, maintaining dry air under pressure by a separate apparatus would be an expensive process both in first outlay and subsequent maintenance.

The employment of dry air, however, in wrought-iron pipes has obvious merits as a cheap and manageable insulator, and is well worthy of being developed. The details of the system have not yet been worked out, and the models exhibited showed a new principle, but not so far a practical system.

FIG. 7.

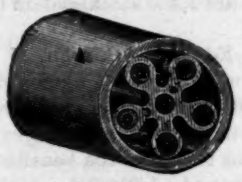


FIG. 8.

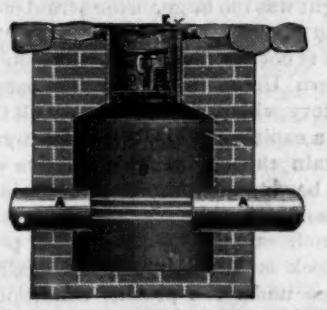


FIG. 9.

The American Bell Company's Capital.

The hearing was begun, at Boston, on March 4, by the Massachusetts legislative committee on mercantile affairs, on the petition of the American Bell Telephone Company for an amendment to their charter whereby their capital may be increased from $10,000,000 to $30,000,000, also the order relative to placing telephone companies more fully under State supervision or inspection, and on the petitions of E. H. Morse, H. L. Hastings, Edward Conkey, Jesse L. Nason and others for legislation relative to the reduction and limitation by law of the charges for telephone service. The committee consists of Senators Norris of the Cape district, Andrew of Suffolk and Emerson of Essex, and Representatives Greenhalge of Lowell, Farrar of Bradford, Munyon of Pittsfield, Townsend of Lawrence, Story of Lancaster, Brightman of New Bedford, Read of Boston, and Leahy of Boston.

The petition of the American Bell, for an increase of capital, was first heard. John E. Hudson, regular attorney for the company, and Hon. Geo. A. Bruce appeared for petitioners. The latter said that it was the company's desire to enter upon a vast work of great public importance under the laws of Massachusetts, because those laws are favorable to business enterprises.

The American Bell Company own the right in the United States of transmitting human speech by electricity, and they desire the necessary legislation to enable them to enlarge the operations of a beneficent system. Mr. Bruce traced the invention of Alexander Graham Bell, of Cambridge, in 1876, its introduction in 1877, the formation of the New England Telephone Company in 1878, with a capital of $450,000, and in 1879 the National Bell Company was organized under the laws of Massachusetts with a capital of $850,000. At this time arose the many claimants to the right of the invention. In 1880 the American Bell Telephone Company asked for authority to increase their stock to $15,000,000, but the committee hearing their petition would allow them but $10,000,000, intimating that if a larger capital should be required in the future the Legislature was always open. Since 1880 the American Bell Company has gained control of all companies in the United States, operating 100,000 miles of wire, and there is not a city or town of 3,000 population that has not its telephone exchange. The telephone company is now, by its detached systems, in just the same condition that the telegraphic system of the country would be in if it were divided up into small systems. The American Bell desires to connect every system in the United States, so that direct telephoning may be accomplished to all parts of the country. What objection can there be to this? If it is feasible the right should be granted. He claimed that now it was as easy to be heard talking across the country as in the early days of the invention it was between Boston and Cambridge. In the event of the increase of capital asked for, it is to be devoted to increasing the national facilities of the company, who will then construct larger systems between all the large cities, comprising a total distance covered of 5,060 miles, and 247,720 miles

of wire. The carefully estimated cost of this first venture would be: For poles, $1,000,000; copper wires, $9,000,000; rights of way, $1,000,000; labor, $2,000,000; a total of $13,500,000. If the business is legitimate, then the means to this end must be secured. The largest corporation in the world, the Suez Canal Company, has a capital of $300,000,000. To accomplish great things requires great means. Mr. Bruce said he could not find any reason why this petition should not be granted. It is the policy of many of our States to allow legitimate business enterprises unlimited capital. It is so in New York, New Jersey, Pennsylvania, Ohio, Illinois and many other States. The American Bell Telephone Company are determined to accomplish the establishment of a system of long-distance telephoning under the laws of some State, but would rather do it under the laws and with the sanction of Massachusetts.

Wm. H. Forbes, of Boston, president of the American Bell Company, was called as the first witness. He said that Mr. Bruce had fully and accurately set forth the desires of the company, the chief of which was that they want to establish a group of systems, covering the whole country. The expense of doing this has been so large that other and smaller companies are not willing to undertake the building of these long systems. The American Company now pay $23,000 in taxes to Massachusetts, which is upon about one-twelfth of its possessions. The total capital of all companies in the country is something over $50,000,000. Mr. Forbes stated that long-distance telephoning is now feasible. Recently the company constructed an experimental line between Boston and New York with excellent results, and there is no question as to the practicability of transmitting messages for long distances. In regard to whether, from a business point of view, the long-distance telephoning was demanded, Mr. Forbes stated that the company have been asked by large wholesale houses to establish the system between Boston and New York. He believed the benefit to business men and consequent income to the company would warrant its construction. There are 1,400 stockholders in the American Bell Company.

Mr. Edward Atkinson, of Boston, a prospective user of the long-distance telephoning system, but not interested financially in the company, represented the united manufacturing interests to the extent of $375,000,000, who are anxious to secure the benefits to be conferred by the establishment of a long-distance system.

Jonas H. French, member of the Massachusetts Senate of 1880, when the act incorporating the Bell Telephone Company was passed, said that the company wished then to be authorized to have a capital of $15,000,000. This he then thought was too large, being afraid of water, but since then he had studied into the matter and found that now $30,000,000 is not too much, and will soon prove too small. The Western Union Telegraph Company, covering the same territory which the American Bell Company seek to cover, has a capital of $80,000,000. He urged that the State should retain the company, and derive what benefits are thereby to be obtained, instead of allowing them to go to other States.

Col. French saw no objection to the petition, if watering the stock is carefully guarded against, as appears to be the case under the present condition of affairs. To Mr. Greenhalge he said that the high price of Bell telephone stock does not, in his opinion, justify legislation regulating the charges. This matter should be left to supply and demand. Legislation of this sort does not prove beneficial. The present rates are not extravagant for services rendered, and that they are not too large appears to be proved by the fact that the sub-companies are making no money.

The case for petitioners was ended here.

Railroad Telegraphic Facilities.

As stated in these columns last week, Mr. William H. Armstrong, United States Commissioner of Railroads, has completed his report regarding the allegation that the Union Pacific Railroad Company grants special telegraphic facilities on its line to the Western Union Company. The Baltimore & Ohio Telegraph Company recently asked the officers of the Union Pacific Company for the same privileges and facilities that were extended to the Western Union. The application was not successful. President Bates, of the Baltimore & Ohio Telegraph Company, went to Washington a few days ago and had an informal interview with Commissioner Armstrong and counsel for the Union Pacific Company. The demand of the Baltimore & Ohio Company was as follows:

"That the Union Pacific Railway Company and all the land-grant railroads shall accept from the Baltimore & Ohio Telegraph Company a general telegraph business upon the same terms as to rates and conditions and the keeping of accounts as the Union Pacific and the other land-grant roads accept like business from the Western Union Telegraph Company, and that the Union Pacific Company shall accept at its stations messages which may be tendered to its operators destined for points on the Baltimore & Ohio Telegraph Company's lines, as such destination is indicated in the message, and transfer at the connecting points such messages to the Baltimore & Ohio Company, and, further, that in the conduct of such general exchange of telegraph business the same facilities shall be given us—namely, wire or mechanical connection, the keeping of accounts, etc.—as are furnished to the Western Union Telegraph Company."

On behalf of the Union Pacific Railway Company it was said that the view entertained by its officers was that that company is limited to dealing with the Baltimore & Ohio Telegraph Company precisely as if it were an individual offering a message or a succession of messages. The Union Pacific people do not believe that their duty in this matter extends to the keeping of a system of mutual accounts, the extension of credit, or the affording of mechanical connection. Commissioner Armstrong's conclusions are as follows:

"It will be observed that the real controversy—being the claim of distinct affirmative rights upon the one side, as distinctly denied upon the other, and both arising under variant construction of the same law—is, as it stands at present, a question clearly within judicial adjudication. I have deemed it to be within the spirit of the resolution to embody in my reply the respective views of the rival interests which are involved. Whether the question thus presented is one for legislative action must rest exclusively in the discretion of Congress."

This matter, it is said by some of the persons interested, will be brought to the attention of the next Congress.

A New Insulator Bracket.

The accompanying cut represents the "new concaved bracket," manufactured by Messrs. Brownlee & Co., of Detroit, Mich. The advantage claimed for it over the flat-

faced bracket in common use, is that it fits closely without requiring the pole to be dressed, thus at once saving labor in putting up the line, and insuring greater strength when in position. The new bracket costs no more than the old style. Messrs. Brownlee & Co. have applied for a patent.

The Electric Light in France.

There has recently been organized in Paris a company which will run a number of small steamboats on the Seine. The boats, thirty-two in number, are already in process of construction, and they will be lighted by electricity. Each one will have 22 incandescent lamps of 16 candle-power, distributed throughout the vessels, with the exception of the decks. Power will be furnished for each plant by a small steam-engine of 5½ horse-power and of a specia design. The dynamo is of the Gramme type, modified by M. Rafford; running at a speed of 150 revolutions per minute, they will give a current of 18 ampères at an E. M. F. of 110 volts.

Besides the twenty-two lamps which illuminate the boat, the dynamo supplies current for the signal light. The latter will consist of a powerful reflector, with one incandescent lamp before it. On one side of it there will be placed an oil lamp, so that in case of accident to the machine, some other light will be available. The firm of Bregnet has undertaken the installation of the plants.

The Two French steamers, "Château Yquem" and "Château Margaux," which have recently been chartered to transport French troops to Tonquin, are also lighted by electricity. Each has about 200 lamps on board, which were put in by the same firm.

The Baltimore & Ohio in Pennsylvania.

In regard to the work being done in Pennsylvania by the Baltimore & Ohio Telegraph Company, a dispatch of March 3 from York, Pa., says:

The Western Union Telegraph Company has again failed in its efforts to prevent competition, the Baltimore & Ohio Telegraph Company having opened an office in this place to-day, with a sweeping cut in rates. The line from Baltimore, 60 miles, has been completed within fourteen days, with the thermometer much of the time below zero. Poles have been cut in the woods since Feb. 1.

Telegraph men generally will appreciate this remarkable work. The line had been completed to the suburbs of York before the Western Union Company was aware of its existence, and although the city councils had granted the necessary rights to build the line through the streets of York, steps were taken by the Western Union Company to prevent its construction. The city solicitor was retained and an opinion given against the rights of the competing line on the ground of some technical inefficiency in their Pennsylvania charter. The chief burgess and police department were prevailed upon to stop the work, and the Baltimore & Ohio workmen were arrested. The Baltimore & Ohio, however, soon satisfied the city officials of their mistake, and, upon filing a bond for $10,000 damages, were permitted to construct the line.

The citizens of York are highly indignant over the attempt of the Western Union to obstruct the Baltimore & Ohio line; so much so that at the city election on Saturday, the former city solicitor, who had been retained by the Western Union Company, and who was a candidate for re-election, was, much to his surprise, overwhelmingly defeated.

This is not the first instance in which leading attorneys have taken retainers from the Western Union Telegraph Company in opposition to the Baltimore & Ohio Company, and as candidates for office have been defeated.

We are told that Judge Todd, of Texarkana, was employed by the Western Union Company to oppose the construction of the Baltimore & Ohio along the Missouri Pacific Railroad. Soon after he was nominated for county judge, and while not only competent, but exceedingly popular, the fact of his being in favor of telegraph monopoly led to his defeat.

Mr. Marion, agent of the Missouri Pacific Railroad at De Kalb, Texas, ran for county clerk and was defeated because he had taken active steps to help the Western Union Company in their fight against the Baltimore & Ohio.

When the public have an opportunity of expressing an opinion against would-be monopolies, they do so in an unmistakable manner.

The Philadelphia City Electrical Department.

Chief Walker, of the Electrical Department of the city of Philadelphia, submitted his annual report for 1884 to the mayor recently. The department is now in a more perfect and reliable position than it has been since its creation. "At the present time," says the report, "this and other cities have one continuous net-work of wires, telegraph and telephone, constructed on house-tops, chimneys, and frail fixtures, so that the making of overhead wires reliable in large cities has become almost an impossibility, owing to the interruptions caused by contact from the great number of wires over the streets and across buildings, and from the breaking and falling of wires upon those beneath them; and the constant attention of the department is required in removing wires that have fallen and crossed or become twisted with the city's wires. To obviate the trouble it is absolutely necessary to place the lines in metallic circuits. There is but one remedy to overcome the difficulty of crossing wires, and that is the placing of the wires underground. I am perfectly convinced that the time has arrived to take action for the placing of the wires underground, and also that they can be worked satisfactorily and be made absolutely free from interruptions by that method.

"Many of the wires belonging to the city have been in use for a long time, and are brittle and rusted out. It will be necessary during the coming year to renew and form into additional metallic circuits as many of them as possible. During the year there were issued 737 permits for the erection of poles and wires, but only 190 new poles were erected. Many of the pole lines of the department were rebuilt during that time, and the lines extended to various points for the location of new fire signal apparatus. At the close of the year there were on the highways of the city 4,631 poles, exclusive of those along the lines of railroads; 4,499 miles of telegraph and telephone wires, 115 miles of electric light wires, and 341½ miles of underground wires. Belonging to the city there are 3,449 poles and 411 miles of telegraph wire, making a grand total of city and other overhead wires of 5,025 miles and 8,080 poles."

The Finances of the New England Telephone Company.

The gross and net earnings and construction expenses of the New England Company for nine months of the fiscal year are appended, the construction expenses, plus $28,000 for new apparatus at the Boston office, increasing gross expenditures about $20,000 beyond net earnings. The company's net floating debt, Dec. 31, was about $40,000. The figures are:

	Gross earnings.	Net.	Construction.
April	$75,463.59	$18,338.12	$13,133.82
May	75,368.53	27,341.08	17,634.66
June	77,217.80	22,344.44	12,196.16
July	76,950.50	17,203.12	19,910.55
August	76,963.06	21,033.70	19,609.22
September	76,760.74	14,933.99	14,575.49
October	77,900.75	14,598.81	19,086.19
November	77,704.67	20,962.85	22,746.85
December	77,084.03	*6,061.10	15,831.02
Totals	$691,413.67	$162,817.21	$154,723.96
Boston office			28,056.84
Total			$182,780.80

*Taxes, interest and rebate for the several months, etc.

A Special Sun for the City of Paris.

The latest scheme for lighting the city of Paris must certainly be characterized as tower-lighting with a vengeance. It is proposed to construct a tower over 1,100 feet high, at the top of which there are to be placed lights aggregating in intensity 2,000,000 carcels (a bec carcel equals 9.5 candles).

According to the original plans, the tower is to be situated in the garden of the Tuileries, in the centre of Paris, at a mean distance of 5,200 metres from the fortifications. There are to be 100 lamps of 20,000 carcels each, for which it is calculated something less than 10,000 horse-power would be required. The structure is to be topped off with a powerful reflector, to prevent the useless diffusion of the rays into space.

The project can hardly be called anything but visionary, as tower-lighting experience is not yet far enough advanced to promise the success of an undertaking of such magnitude, but it has been suggested that besides being used for lighting purposes the tower might serve on a limited scale as an aeropathic establishment, and as a station for undertaking various scientific researches.

THE TELEGRAPH.

Sixpenny Telegrams in England.—To meet the expected increase of work when the sixpenny telegram tariff comes into operation, 3,000 additional operators are being trained throughout England.

Cable Statistics.—The sums paid for Transatlantic telegraphy during the past year amounted in the aggregate to $4,400,000, while for the preceding year the amount was $4,650,000, the rate being the same, and the reduction being due to depressed trade.

A New Receiver.—J. B. Butler has been appointed to succeed Messrs. Smith and Newcombe as receiver of the Bankers and Merchants' Telegraph Company. The ex-receivers say that they had great trouble in raising money, and they think their successor will have the benefit of more prompt financial aid.

The Town Signal Service in Vermont.—The Western Union Telegraph Company will give weather signals in Vermont at half rates, except at terminal points. The weather probabilities will be sent to towns daily, except Sundays, at the rate of 25 cents for ten words, for the terminal points, and at half rate for each telegraph office at which they are taken off along the line. By this it will be seen that towns along the line can get the probabilities for about $40 a year, so far as telegraph service is concerned. It has been suggested that towns in voting upon the matter in March meetings should leave details to the discretion of their selectmen.

Another Atlantic Cable.—The following extract from a Portuguese paper of standing (*O Eponomista*) indicates a proposed increase in the number of cables across the Atlantic. The question arises, whether the temporary and simultaneous silence of even four Atlantic cables justifies the laying of another one. It seems that with the competition so keen as it is at present, any addition to the number of cables would be a mistake; but the names of the companies mentioned in the following extract are a warranty that nothing will be undertaken rashly: The Brazilian Submarine Telegraph Company sends to its shareholders a circular intended to show the attitude of that company on the question of the submarine telegraph lines projected for the Azores and the Western Coast of Africa. It gives them to understand in substance the propositions which they, in accord with the Eastern Telegraph Company and the Telegraph Construction and Maintenance Company, have sent in to the government for the establishment of these two lines. The propositions comprehend the establishment within a period of six months, without any subsidy or guarantee of revenue, of a submarine telegraph cable between the Island of Madeira and those of San Miguel and Fayal, and the execution in stated periods of time of extensions; on one hand to North America, either by Newfoundland, St. Pedro Miquelon, or Nova Scotia, or by the Bermudas; and on the other hand to the West Indies and Panama.

THE TELEPHONE.

Between Brussels and Madrid.—It is stated that experiments will be made in long-distance telephony between Brussels and Madrid, using the Dembinski microphone.

On the Congo.—The African Association is about to send to the Congo the telephonic apparatus necessary for establishing communications between stations on the lower part of the river.

The Soudan Campaign.—The "Calabria," belonging to the Telegraph Construction Company, has been taken up by the English Government for three months, and has a staff of engineers busily engaged in fitting her up. Upon her arrival at Suakim she will have a stock of nearly 2,000 tons of fresh water on board. She will also be used there as the headquarter ship. She is taking out several miles of cable to connect her with the shore, and three complete sets of telegraph and telephone instruments.

The American Portable Telephone Company.—The annual meeting of this company was held on the 7th inst. The officers and trustees were re-elected as follows: Henry W. Pope, President; Capt. Lina Beecher, Vice-President and General Manager; C. H. Sewall, Secretary and Treasurer; Henry W. Pope, C. H. Sewall, W. J. Johnston, J. B. Sabine and Capt. Beecher, trustees. Capt. Beecher rendered a report which showed that the company was making good progress. He left New York the same night for Canada, for the purpose of establishing a sub-company in the Dominion.

The National Telephone Company.—This English company, taking advantage of the recent concessions of the post-office, has erected a complete system of trunk lines for inter-communication between the different towns in the West Riding of Yorkshire, and the wires formerly rented from the post-office have been given up. The company also proposed establishing a telephonic exchange in Arlensburgh, with communication to Glasgow. The rate within a mile radius of the post-office will be £10 per annum. For communication to Glasgow the single trunk rate will be £12 10s. per annum, or at the rate of sixpence per conversation of three minutes.

Telephones in Paris.—The Société Générale des Telephones, of Paris, has extended its facilities for the dispatch and reception of telegraphic messages. This extension has been in public use since Feb. 15. On paying a supplementary rental of 50 francs a year, and the deposit of a sum intended to cover the amount of the telegraph tax for which the company is responsible to the state, the subscriber can transmit and receive telegrams. The text of the dispatch is necessarily in French, and must be preceded by the word "Telephone" to prevent its delivery by the ordinary method. The company transmit the message by telephone, confirming the wording by the earliest post.

Removing from Boonville to Evansville.—Mr. George L. Masters left on Monday for Evansville, says the Boonville, Ind., *Standard* of Feb. 17, to assume the general management of the Bell Telephone Company's interests at that place and through the surrounding country of Southern Indiana and Illinois and Western Kentucky. Mr. Masters has had charge of the exchange at this place for the past two years, and by his energy and zeal thrown into building up the company's interests here and through this division, he has made it a success, and merits the position of general manager which has been awarded him. Mr. Masters has long been known by the citizens of Boonville and vicinity as a man of integrity and ability, and his friends will be pleased on hearing of his promotion in the telephone interest. Mr. Masters will continue to hold his commission as postmaster; his deputy, Ben. F. Downes, will conduct the business of the office, with Capt. T. J. Downes as assistant.

Temperature by Telephone.—Dr. Lenz, in the *Bulletin* of the Academie des Sciences de Saint Petersbourg, describes an ingenious application of the telephone to the measure of differences of temperature between stations at a distance from each other. Suppose the two stations to be united by two dissimilar wires—say of silver and iron—with a soldered joint at each end; if the temperatures of the two joints are dissimilar, a thermo-electric current will be developed, and circulate in the wires. If, now, a telephone and interrupter be brought into the current, the former will sound until the temperature of the ends is equalized, when the current ceases and the telephone becomes silent. The experiment was made upon stations only one meter apart, when the results obtained showed a probable error of one one-hundredth to one two-hundredth of a degree centigrade. The observers consider that, with iron and silver wires of 2 millimetres in diameter, indications could be obtained at distances of 5 kilometres (3⅛ miles), but that wires of bismuth and antimony would be efficacious at distances of 25 kilometres (16⅛ miles).

The Chinese Telephone.—At the last meeting of the China Asiatic Society at Shanghai, an instrument, which was a species of primitive telephone, was presented for inspection by Dr. Macgowan, of Wenchow. It consisted of two bamboo cylinders, from 1½ to 2 inches in diameter and 4 inches in length; one end of each was closed by a tympanum of pig bladder, which was perforated for the transmitting string, the latter being kept in place by being knotted. This rude instrument is called the "listening tubes," and is employed for amusement as a toy, conveying whispers 40 to 50 feet. It is unknown in many parts of China, the provinces of Che-kiang and Kiangsu being the only ones, so far as can be ascertained, where the listening tubes are employed. Besides this toy, Chinese ingenuity produced, about a century and a half ago, the "thousand-mile speaker." This instrument is described as "a roll of copper likened to a pipe, containing an artificial device; whispered into, and immediately closed, the confined message, however long, may be conveyed to any distance, and thus, in a battle, recent instructions may be conveniently communicated. It is a contrivance of extraordinary merit." The inventor of the "thousand-mile speaker," one Chiang Shun-hsin, of Huichou, flourished during the reign of Kang-hsi, during parts of the seventeenth and eighteenth centuries. He wrote on occult science, astronomy and foreign physics, and the above description of his invention was copied from his works into a provincial encyclopædia. At the time the latter work was published—in the reign of Kien Long—there was no longer an instrument of this kind in the province, as the ingenious invention appears to have perished with the student who contrived it.—*Nature.*

THE ELECTRIC LIGHT.

Keokuk, Ia.—The Badger Electric Light Company has strung wires at Keokuk, Ia., for sixty lights. The plant will be in operation by April 1.

Mobile, Ala.—The Mobile (Ala.) Electric Light Company are expecting a new Thomson-Houston plant, in connection with which they will use the Ball engine.

How to Get a Dinner.—A flock of ducks flew into the electric light of the steamer "Barksdale" on a recent morning and furnished the officers a duck dinner.—*Vicksburg (Miss.) Herald.*

Joseph Wilson Swan, the electric light inventor, lives elegantly at Bromley, Eng., and is described as a handsome man, with a noble head set on a rather long neck—a distinguishing characteristic of the Swan family.—*N. Y. World.*

Cheyenne, Wyo.—Mr. F. E. Warren, the new governor of Wyoming Territory, is also president of the Brush-Swan Electric Light Company of Cheyenne. To celebrate his inauguration, the citizens of Cheyenne serenaded him. The company furnished the lights by taking their battery wagon to the house, in the procession, and having a circle of twenty-five lights on a pole in the wagon. The impromptu installation answered very well.

A Central Laboratory of Electricity.—The Electrical Exhibition of Paris, held in 1881, besides having proved a striking success in a technical point of view, was also a sound financial undertaking, and produced a profit of $65,000. This sum was to be devoted to establishing a central laboratory of electricity. Up to the present time this decree has not been put into execution, on account of unfortunate official delays, and despite the constant demands of the French scientific press. It has at last been announced that the affair is about to enter upon a practical phase, the Municipality of Paris having approved the suggestion of a grant of land upon which the laboratory shall be erected.

A New Incandescent Lamp.—The new incandescent lamp of M. A. Gérard has two very fine carbon filaments, made by being drawn through a plate, like the carbons of arc lamps, thus insuring great homogeneity. By suitably proportioning the lengths of the carbons to their diameter, the consumption of the lamps in volts and ampères may be varied at pleasure, thus obtaining a wide range of luminous power from 2 or 3 candles to 500 or more. The carbons are joined together at their summit by a carbon paste, and are received below by two carbon cylinders of larger diameter, in connection with platinum wires which are soldered to two armatures embracing the lower portion. The lamp is put in place by inserting it into a spring socket, which is fixed to the bottom of the lantern.

A Story About Edison.—Rather a good story is being told at the expense of Edison. He has lately taken to wearing a high silk hat. Walking up from his east-side laboratory the other day, in his customary fashion, hands clasped behind his back and eyes seeking the earth, he was much astonished to observe that the boys and girls made way for him with many marks of deference. Some took off their caps. Finally, he was stopped by one little fellow, who said: "Father O'Brien, me mother, Mrs. Maloney, of Avenue A, bids me ax your Rivirince, since you be so oftin passin', to be kind enough to drop in on me grandmother, Mrs. Foley, who is clean gone with the rheumatism." "Father" Edison now wears his hat on one side and smokes a big cigar in going to and from his laboratory, much to the bewilderment of the youth of Avenue A.

Silvered Incandescent Lamps.—There are many situations in which a considerable part of the light of an incandescent lamp is thrown on to surfaces, such as wall papers, which reflec but a very small portion of that which they receive, and thu much of the illumination is lost. To remedy this, several patent have been taken out for silvering one side or the top of the globe so that the whole of the light may be emitted in one direction and thus be turned to useful account. Some of these patents have been acquired by Messrs. Woodhouse & Rawson, who are now producing lamps of all sizes silvered at the top, bottom, or side, according to the position in which they are to stand. By this device the outline of the filament is lost, and the globe is filled with a soft, mellow light very agreeable to look at.

Artificial Ball Lightning.—An effect which bears a strong resemblance to ball lightning has been produced by M. Planté with the help of a battery of 16,000 Planté couples, giving an electromotive force of about 40,000 volts on first discharging. He prepared two pads of filter paper, moistened with distilled water, and brought them very near together, with, however, a layer of air between, the whole forming an air condenser. The pads were connected to the poles of his battery or accumulators, and he then observed a small globule of fire or mimic lightning moving about between the pads, and sometimes passing from one pad to the other. When a pad became dry at any point, the light appeared at some other point, but would reappear at the old place when it was moist again. The likeness to fire balls is very striking; their peculiar wandering character is imitated; and if one supposes the pads of the air condenser to represent the wet earth and a charged cloud, the analogy becomes still more remarkable. The late C. F Varley suggested that ball lighting might be the luminous end of a discharge traveling about on the surface of the earth, and M. Planté's experiment tends to support this view.

APPLICATIONS OF POWER.

Bidwell System.—An exhibition has been given at Philadelphia recently of the Bidwell electric railway system.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 54⅛, a 56; B. & M., b 2, a 2½; Mutual Union, b 14, a 16; Western Union, b 60, a 60⅛.

Telephone.—Am. Bell, b 218½, a 219; N. E. Telephone, b 29; Mexican Tel. Co., b 1⅝.

Electric Light.—Amer. Elec. & Illu., com., b 1⅛.

MISCELLANEOUS NOTES.

A New Thermo-Electric Battery.—Professor Riatti has constructed a thermo-electric cell, based upon the principle that the production of electricity is due to the difference of the temperature of two parts of a single fluid. The cell consists of a receptacle of wood or porcelain, traversed by two tubes of copper, with wires at a certain distance between them. By the principal tube a jet of steam is passed, and by the other cold water. The outer jar contains a solution of sulphate of copper. When the circuit is made, the copper of one of the tubes is dissolved, and is deposited in the other. This cell is said to be constant, and not liable to polarization.

A Selenium Actinometer.—M. Morize, of Rio de Janeiro, has devised a selenium apparatus for measuring the relative intensities of the rays of the sun at different altitudes of the luminary above the horizon. It consists of a selenium cylinder prepared according to the plan of Professor Graham Bell, 38 discs of copper being isolated from each other by smaller mica discs, and the edges filled in with selenium. It is insulated by glass supports inside a glass envelope from which the air has been exhausted. The vessel is elevated in a place where surface reflection does not reach it, and the axis is placed parallel to the axis of the earth, so that the rays of the sun fall normally on the selenium cell and illuminate the same surface. Its position can be altered to keep up this condition from day to day. A constant current traverses the selenium and a galvanometer in circuit with it. From darkness to the most intense radiation of the sun is the range to be observed, and a scale is graduated accordingly; Clammond's battery is that employed.

Oxidation of Oil by Electricity.—Herren Muthel and Lutke, of Berlin, have devised a process for oxidizing rapidly, with the help of electricity, the oils employed in the manufacture of varnish. Oxidated combinations of the metalloids, which by an elevated temperature lose a part of their oxygen, are formed by the influence of electricity. Suitable for this purpose are mixtures of equivalent quantities of chlorine and vapor of water, sulphurous acid and atmospheric air, oxygen, or hyponitric acid, protoxide of nitrogen with air or oxygen. Such a mixture of gas is submitted during some time, in condensing apparatus, to a strong electric discharge, produced by a dynamo and an induction apparatus. In this manner 2HCl and O give birth to Cl_2 and H_2O, and S_2O_7 form by electrification a mixture of SO_2 and atmospheric air. This combination easily resolves itself into $2SO_2$ and O, etc. The linseed oil to be oxidized is warmed in a vessel to 60 degrees or 80 degrees Centigrade. Oxidized gas is sent through the oil while it is being agitated, and the decomposition of the glycerides is rapid. The products of decomposition are regenerated or burnt; and the clean product is washed with ammoniacal water.

Determination of the Ohm.—In a recent note before the French Academy of Science, M. Mascart remarks that all methods give a greater length than 106 centimetres of mercury, except that of neutralization (*amortissement*), while this method has, on the contrary, always given a lower number; and he inquires if a more complete interpretation of the theory might not furnish an explanation of this difference. It results from his researches that the correction to be made in the approximate calculation of the resistance, taking into account the coefficient of self-induction, should be somewhat less than that usually made, and that the strong induced currents should give the bar, in a transverse direction, a temporary magnetization, which must be taken into con

sideration. These two corrections contribute to increase the value of the intensity of resistance hitherto found by the method of neutralization, which fact explains why the figures which it gives have always been found under the mark. M. Rene Benoit has recently presented the Ministry of Posts and Telegraphs with four copies of the legal ohm as it has been defined by the International Conference of Electricians. M. Benoit has already done some very valuable work in connection with platinized iridium metrical standards.

BUSINESS NOTICES.

Portable Hoists.—Mr. James Dunn, Cleveland, O., has a very useful apparatus in Bailey's Portable Hoist, by means of which very heavy machinery can be lifted easily. It has also been employed successfully in the erection of electric light masts, of which the number is now increasing so rapidly. It is made of cast iron, but can be furnished in steel if desired, and with extra quality of chain.

"Gonda."—The great success which has attended the introduction and sale of the Leclanché "Prism" battery, manufactured by the Leclanché Battery Company, of 149 West Eighteenth street, New York City, has led the latter to give their battery a distinctive name. For this purpose they have adopted the trade-mark "Gonda," and henceforth their "prism" will be known as the "Gonda" battery. The popularity of Leclanché batteries is seen in the fact that over half a million are in use in this country and more than a million in Europe. Strange as the new name may now sound to many of our readers, it will soon become as "familiar in the ears as household words."

Electric Light Carbons.—The Parker-Russell Mining & Manufacturing Company, of 711 Pine street, St. Louis, Mo., have been at work making electric light carbons for the last eighteen months, and are now erecting a plant which will have a capacity at the outset of five million points per annum. It will be in operation by April. The company say: "Our processes differ in every feature from those of other manufacturers, and are of our own device and invention. Each carbon is, from the beginning to the end, manipulated separately, and is therefore in every part homogeneous and uniform. In straightness, length of time in burning, brilliancy and steadiness of light, they excel all others, and will be adapted to the various systems of lighting in use." Mr. G. W. Parker is president of the company, and Mr. L. M. Fishback will have charge of the sales department.

Anti-Magnetic Shields for Watches.—The application of anti-magnetic shields to pocket time-pieces promises to be of great importance. It will render operative the fine adjustments and mechanisms which hitherto have been made almost *nil* and inoperative on account of their susceptibility to the all-pervading magnetic influence. It is undoubtedly a fact that the variations in time or rating of watches carried by railroad men have been in most cases caused by magnetism instead of by jolting, as has been heretofore thought. The anti-magnetic shield made by Giles Brothers & Co., State and Washington streets, Chicago, is a protection for the works of a watch against magnetism from any source, and the attention of people who desire their watches to keep good time is called to this fact. Giles Brothers & Co. have many testimonials in regard to the efficacy of their shields when applied to watches. They also demagnetize watches which are already affected.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEB. 24, 1885.

Railway Signaling Apparatus; Wm. Hadden, Brooklyn, N. Y..... 312,627

From the top of the casing is suspended a lantern by means of a strap, so that when undisturbed it will always hang normally in the same position. The lantern is provided at the lower end with a spindle, which turns loosely in a bearing in the bottom of the casing. By means of two electro-magnets, two circuits and the suspension strap, three separate and distinct signals can be given.

Galvanic Therapeutic Apparatus; Theodore Schmauser, Allegheny, Pa..... 312,660

Consists of the combination with the cell casing provided with the front supporting devices, of the rear suspending-rod having its lower end pivotally connected with said casing and its length divided into alternate cylindrical flat portions, and a suitable rod support and guide located at a point above the cell casing and adapted to permit the rod to slide up or down in one position and to engage the flat portions of said rod when they are turned at right angles to such position.

Combined Telegraph and Telephone; Henry C. Strong, Assignor of eleven-fifteenths to David A. Strong and Henry P. Caldwell, both of same place.... 312,670

The mechanism comprises an ordinary telegraphic signal instrument connected with the line wire, having one-half of its armature removed and the other half operated in the usual way by the portion of the electro-magnet over which it lies, and having the remaining portion of the electro-magnet provided with a permanent magnet affixed to its core, and with a cup and diaphragm to constitute it a telephone.

Electrical Conductor; Colin E. Thompson and Charles R. Eberle, Brooklyn, N. Y..... 312,673

A core of copper wire, or wire of any other metal of low electrical resistance, insulated or not, as required, is covered with an outer casing or armor of steel or other metal of sufficient tensile strength, wound helically about the core in thin narrow strips, so formed as to overlap and leave a smooth cylindrical exterior surface. The compound wire thus formed is then passed through a bath of molten tin, zinc or other metal or alloy that melts at a low temperature, the effect being to firmly solder the edge of the strip together, making a continuous hollow cylindrical covering or armor for the inner conducting-wire.

System of Electric Lighting by Secondary Batteries; Alexander A. Bauer, Baltimore, Md., Assignor to the Viaduct Manufacturing Co., of same place..... 312,698

He distributes the accumulator currents from one or more central stations, where all the batteries are kept under the constant immediate supervision of persons skilled in their management, and where the cells may be charged, connected in consumers' circuits, tested, interchanged and kept in order, and from whence proper currents may be maintained on all circuits without trouble to consumers and at a minimum expense to the suppliers.

Dynamo-Electric Machine; William M. Morley, Putney, England..... 312,745

He builds up the core of the armature, which, according to his invention, is of the ring-disc type, of a number of plates separated from each other by non-conducting material. He not only separates the parts forming the core of the armature magnetically, but also electrically, and to this end he insulates all the bolts or

PATENT NO. 312,807.

rivets by which the said parts are connected together, or forms them of non-conducting material, and thus obviates to a great extent the generation of Foucault currents.

Cable Hanger; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Co., same place..... 312,755

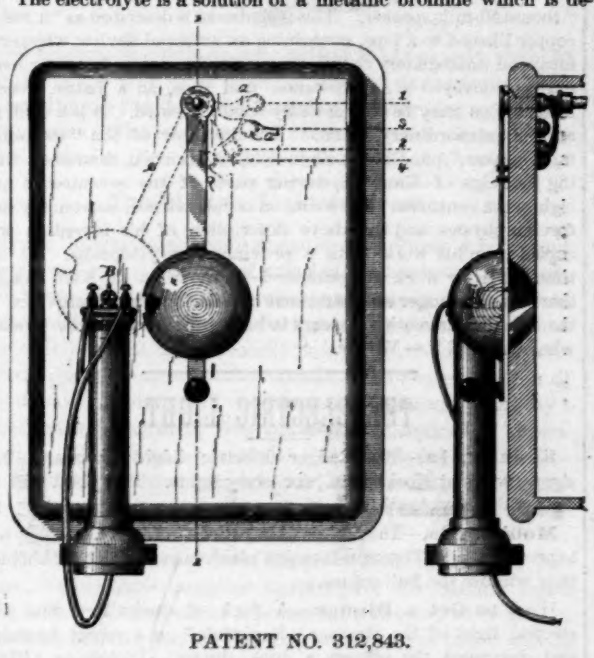
Consists in a rigid hanger having a single round bearing surface upon the suspending wire, and a flat surface around the pipe. The hook is preferably of malleable iron galvanized, and is provided with a lug on the back to keep the nut of a bolt from turning, and a lug and projection on the front by which the zinc clamp is secured thereto. The clamps may be made all of the same size, and adapted to different sized cables by using washers, preferably of iron, of different widths. The clamps may be painted and sanded to prevent slipping where they come against the pipe.

Electric Lamp Support; Frederick U. Adams, Chicago, Ill., Assignor, by direct and mesne assignments, to the Adams Electric Mast Co., same place.... 312,789

A lamp carriage and a passenger cab are connected by a tackle passing over pulleys at the top of a mast, to be drawn to and from each other on the mast and meeting at the connection of central guys. The lamp carriage has a greater and lesser ring surrounding the mast, which rings engage corresponding stops at the top of the mast. Openings are provided in the railing of the cab for the guys. Means to draw and hold the cab consist of arms on the mast near its base, having vertical rods passing through openings in the cab-platform and provided with hand nuts.

Secondary Battery; Charles S. Bradley, Yonkers, N. Y., Assignor to the Bradley Electric Power Company, of New York, N. Y..... 312,802

The electrolyte is a solution of a metallic bromide which is de-



PATENT NO. 312,843.

composed when the battery is charged, the metal being deposited upon one electrode and the bromine being set free at the other electrode.

Electrical Conducting Material; Charles S. Bradley, Yonkers, Assignor to the Bradley Electric Power Co., New York, N. Y..... 312,803

Consists of the combination of gas retort carbon, or other carbon which has grit, and vulcanized gutta percha.

Armature for Dynamo-Electric Machines; Charles F. Brush, Cleveland, O..... 312,807

The armature ring is formed of superposed layers or convolutions of band iron, with laterally projecting cross-pieces interposed between the same, said cross-pieces forming the side walls of the bobbin-spaces, and rivets or bolts extending through both bands and cross-pieces, and insulated in whole or in part therefrom, as shown in the cut.

Apparatus for Treating Metals by Means of Electrolysis; Henry R. Cassel, New York, N. Y... 312,814

Consists in subjecting the anodes and cathodes, while separated by a partition of dialyzing material, to the action of an electric current in an acidulated solution, said solution being in continued circulation.

Repeater for Submarine Cables; Moses G. Farmer, Newport, R. I..... 312,831

Comprises the combination, with a cable containing a continuous line and a sectional main line or wire, of one or more devices for repeating signals from one section of the main to another, each consisting of a primary coil in the continuous line, means for reversing the direction of current through the coil connected with and operated by one section of the main and a secondary coil in the next succeeding section.

Telephone; W. Hadden, Brooklyn, N. Y..312,841 and 312,842

The first consists in attaching the diaphragm to the inside of the front of the case by means of screws, while it is held at a proper distance from the case, so as to form a suitable air-chamber, by means of tongues or partly separated sections of the diaphragm, which are bent outward so as to form supporting feet or springs. The second consists in the application of a permanent magnet to the instrument, in close proximity to the diaphragm, with its respective poles near the middle of the plate, and so placed that its armature or keeper may be moved to or away from the poles, thereby varying the effects of its magnetism upon the vibrations. Such organization is adapted to dampen the diaphragm.

Telephone Switch; William Hadden, Brooklyn, N. Y..... 312,843

Consists in providing a swinging cover for the mouth-piece of the transmitter, which must be turned aside before the latter can be used, and in placing a support for the telephone in such a position that the cover can only be removed from the transmitter after the telephone is taken from its support. The movements of the swinging arm also make the necessary circuit connections from the call to the telephone, and vice versa, as shown in the cuts.

Battery Telephone; Thomas D. Lockwood, Malden, Mass..... 312,871

Consists in the use of particles of magnetizable metal as the variable resistance medium.

Telephonic Apparatus; Charles A. Randall, Brooklyn, N. Y., Assignor by mesne assignments to the National Improved Telephone Co..... 312,896

The vibrations of the diaphragm are communicated by means of a compound lever to the electro-magnet core.

Electric Fire-Engine System; Schuyler S. Wheeler, New York, N. Y., Assignor to Chas. A. Cheever, trustee, same place..... 312,939

Comprises two general parts: first, an electric fire-engine, which consists of a frame mounted upon wheels carrying an electric motor and a suitable pump mechanically connected, so as to be worked by the motor; and, second, apparatus for supplying the fire-engines with the required electric current, which consists of a central generating station furnished with stationary dynamo-electric machines and with motive power for producing the electric current, and electrical conductors for transmitting the current to the engines, which branch out in all directions from the generating station, and extend to the various street hydrants at which the supply of water is obtained.

Apparatus for Rectifying Spirits and Spirituous Liquors by Electricity; Thomas E. Atkinson, San Francisco, Cal..... 312,948

Consists of electrodes of wood made partially of a conducting nature by being charred or by having carbon rods run through them.

Automatic Cut-Out for Electric Apparatus; James Du Shane, South Bend, Ind..... 312,985

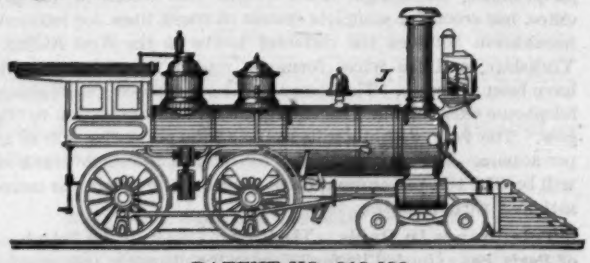
Consists of the combination, in an electric switch, of stationary contact pieces forming part of a short circuit connecting with the line-circuit maker and breaker, and the flat springs and lever arm to hold the contact maker and breaker away from or against the contact pieces when initially started in proper direction.

Electric Arc Lamp; Mirabeau N. Lynn, Rising Sun, Ind., Assignor to the American Electric Headlight Co., Indianapolis, Ind..... 313,006

Consists of the combination, with an oil or gas lamp whose flame occupies a focal position within a reflector, of an electric lamp, the carbons whereof are projected from opposite sides of the reflector and terminate at one end within the chimney of the gas or oil lamp and in proximity to the burner thereof.

Electric Lamp for Locomotives; Mirabeau N. Lynn, Rising Sun, Ind., Assignor to the American Electric Headlight Co., Indianapolis, Ind..... 313,009

The operation of the lamp is as follows: The holders having been balanced, the compensating springs adjusted with respect to the length and weight of the carbons, and the proper focal position secured, the pulleys and worm-gear are clamped tightly to the shaft. The gear-train and feeding mechanism are likewise separately balanced by adjusting a weight on its supporting arm, and the tension of the retracting spring is adjusted with reference to the power of the electro-magnet, which latter is in circuit with the carbons. As soon as the current is established, the electro-magnet raises the front of the platform, thus locking the gear-train, and at the same time causing the descent of the vertical shaft, and the worm thereon acting as a rack causes the backward revolution of the worm-wheel and shaft. By this movement of the shaft the carbons are caused to separate until the desired arc is formed. As the carbons burn away, and the arc elongates, the resistance increases, the power of the electro-magnet diminishes, and the worm-shaft is carried upward, causing a rotation of the worm-wheel in the direction of the feed. As soon, however, as the platform in its movement under the varying influence of the electro-magnet and the retracting spring reaches or falls below the neutral line, the detent releases the gear-train, and the carbons are, by the rotation of the worm-shaft, caused to approach each other until the electro-magnet again raises the platform and locks the gear-train.



PATENT NO. 313,039.

Focusing Electric Arc Lamp; Leonidas G. Woolley, Indianapolis, Ind., Assignor to the Ohio Power and Light Co., Dayton, O..... 313,039

Consists of the combination of an electric lamp, a reflector therefor, means for adjusting one in relation to the other to compensate for the changing position of the arc due to the burning away of the carbons, and a rod or shaft *J* running to a position convenient to the operator, whereby the light can be focused, as shown in the cut.

Fire-Alarm Signal-Box; John Young, Chicago, Ill., Assignor to Western Electric Co., of same place..... 313,040

Consists in providing means for completing a ground connection in combination with the break-wheel, whereby the circuit of the box will be necessarily closed during a portion of its revolution, so that in case the circuit has been momentarily closed the number of the box may be registered at the patrol station once only, or a less number of times than in the case of a true alarm. The fault is thus located, while no confusion is caused between false and true alarms.

Electric Conductor; William R. Patterson, Chicago, Ill., Assignor to Western Electric Co., of same place. Re-issue..... 10,563

Consists of a central core of one or more conductors, the covering of fibrous material, the lapped lead tape, the joints of the lead tape being protected by shellac or paint, and an outside serving to protect the lead tape.